VOLUME 34 NUMBER 8 AUGUST, 1951

AMERICAN JOURNAL
OF
OPHTHALMOLOGY

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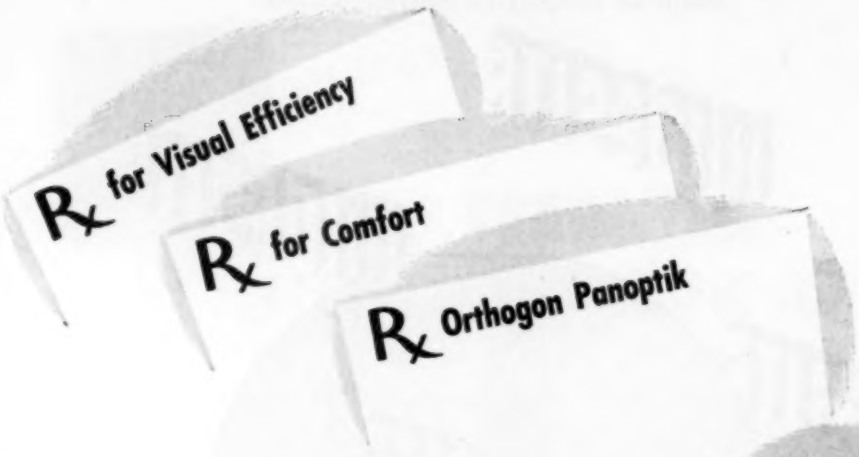

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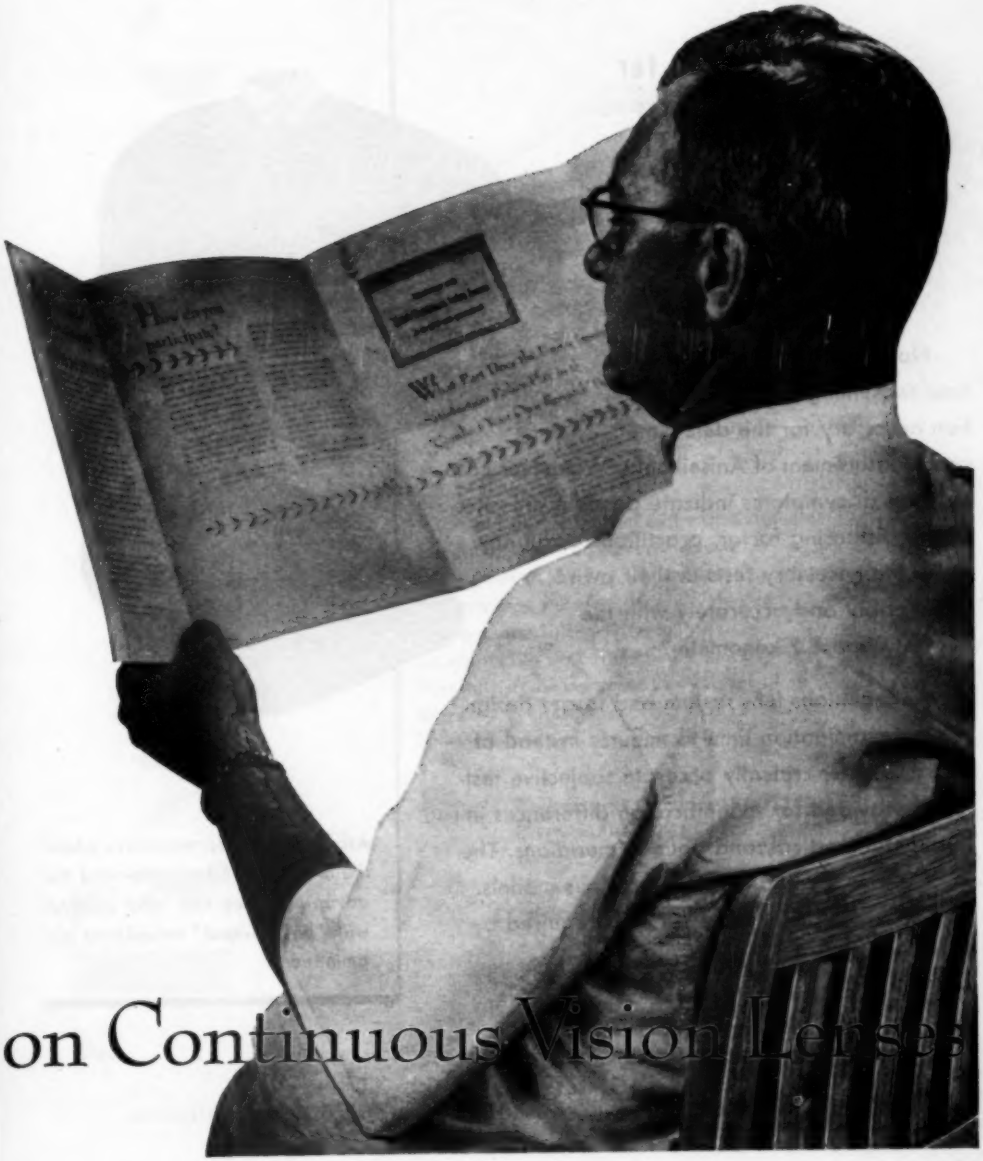

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1. Swan, K. C.: Tr. Am. Acad. Ophth. & Otolaryng.: March-April 1951, p. 406.
2. Theodore, F. H.: J.A.M.A. *143*:226 (May 20) 1950.

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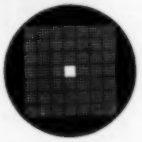
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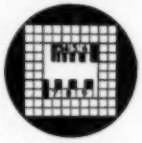
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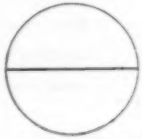
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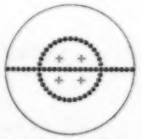
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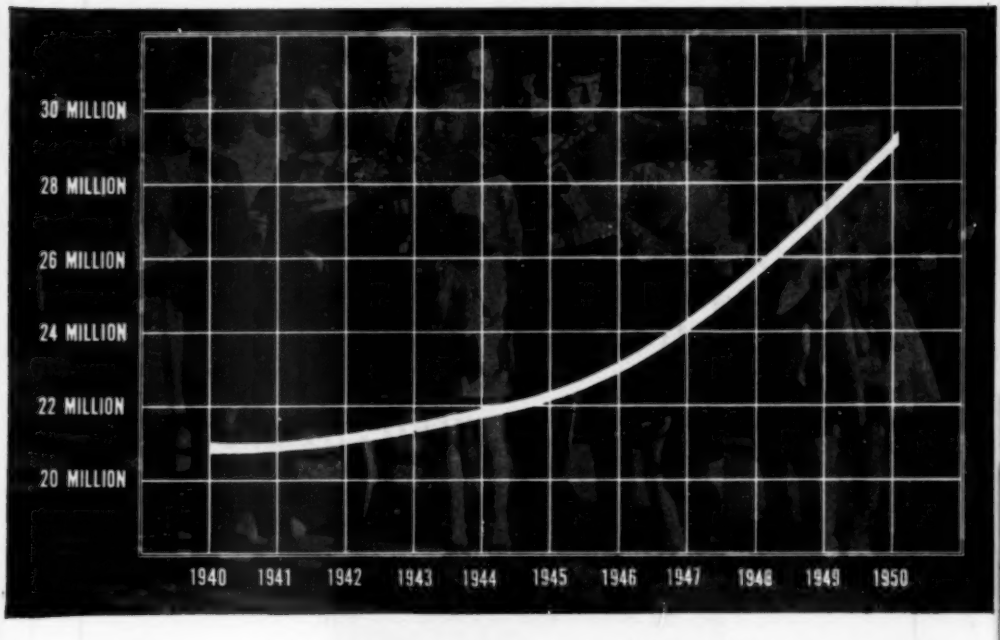

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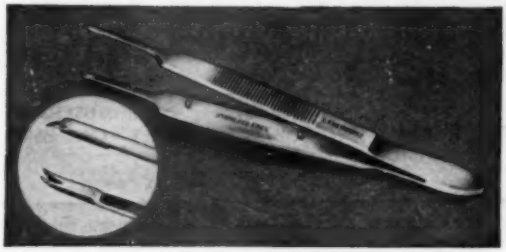

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Compensating for the vertex distance change solved the visual acuity problem *as far as the center of the lens was concerned*. However, due to the great distance from the cornea to the lens (14 mm.) the marginal acuity was unsatisfactory.

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This part of the problem was solved by using a lens only 33 mm. wide. This lens fitted under the brow and permitted a vertex distance of only 8 mm. from the cornea. The distometer conversion scale showed that the vertex correction at this new distance was + 11.12 + 3.37 × 180 which correction was completely satisfactory.

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"IF IT'S A LENS PROBLEM, LET'S LOOK AT IT TOGETHER"

AMERICAN JOURNAL OF OPHTHALMOLOGY

SERIES 3 · VOLUME 34 · NUMBER 8 · AUGUST, 1951

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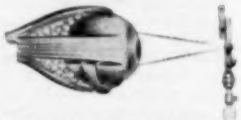

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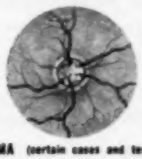

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 34 AUGUST, 1951 NUMBER 8

TOPICAL USE OF CHLORAMPHENICOL IN EXTERNAL OCULAR INFECTIONS*

WINSTON ROBERTS, M.D.
Winston-Salem, North Carolina

Despite recent progress in the use of chemotherapeutic agents and antibiotics, the perfect drug or combination of drugs for external ocular infections has not yet been found. Although pencillin, aureomycin, and various sulfonamides have greatly simplified the treatment of external ocular infections, the development of resistant organisms or strains of organisms and certain disadvantages inherent in various drugs now available make it desirable to find additional antibacterial and antiviral preparations which can be used locally in the eye.

The recognized usefulness of chloramphenicol in a wide range of bacterial, rickettsial, and probable viral infections has suggested its use in topical therapy of external ocular infections. Leopold[1] has recently reported on its excellent penetration into the ocular tissues upon local application.

The preparation of a satisfactory solution of chloramphenicol is extremely simple, since a 0.1-percent or 0.2-percent solution in physiologic saline proved quite acceptable in this study. The chloramphenicol solutions have exhibited excellent stability and appear to retain their activity for at least two to three months. The "gelsiccated" preparation to form 0.5-percent solution, supplied by the manufacturer, is reported to have a similar period of stability; and the one-percent ointment in a "jelene" base, an indefinite period of stability.

Additional advantages, which became evident early in the course of this study, were freedom from toxic reactions and comfort in administration. There have been to date no toxic or allergic manifestations of any type from the use of the solution and only relatively mild irritative reactions to the ointment in three cases. A large proportion of patients have volunteered that the drops produce a definite soothing and comfortable sensation upon instillation.

ANIMAL EXPERIMENTS

To check tolerance, chloramphenicol was instilled topically into the eyes of three rabbits together with sodium sulfacetimide and aureomycin soutions. Table 1 shows that no reactions of any type were produced either by the chloramphenicol or the other two drugs.

Since my initial interest concerned the possible effectiveness of chloramphenicol against herpes simplex of the cornea, 18 rabbit corneas were inoculated by scratch from known herpetic lesions, and chloramphenicol solution (0.1 percent and 0.2 percent) was instilled. Comparisons were made with untreated eyes, eyes treated with sodium sulfacetimide solution, and eyes treated with aureomycin solution (table 2).

It is evident from this small series of rabbit eyes that the results are inconclusive and demonstrate no great advantage of chloramphenicol over either sodium sulfacetimide or

* From Department of Ophthalmology, Bowman Gray School of Medicine. A 0.5-percent "gelsiccated" solution and 1.0-percent ointment of Chloromycetin were supplied by Parke, Davis and Company for this study.

aureomycin in herpetic ulcers of the cornea. My results, like those reported by Thygeson,[2] suggest an inhibitory effect if the chloramphenicol is used very early in the course of the disease but certainly demonstrate no marked antiviral action.

One eye in the series (eye 2) provided findings of outstanding interest. The infection in this eye, initially left untreated, progressed from a dendritic keratitis to severe hypopyon ulcer. It cleared dramatically when chloramphenical solution was used after the hypopyon ulcer was well established.

TABLE 1

TOLERANCE TO CHLORAMPHENICOL

Rabbit	Eye	Drug Solution	Frequency of Instillation	Local Reaction
1	O.D.	None		None
	O.S.	0.1% chloramphenicol	q.i.d. for 10 days	None
2	O.D.	30% sodium sulfacetimide	q.i.d. for 10 days	None
	O.S.	0.2% chloramphenicol	q.i.d. for 10 days	None
3	O.D.	0.5% aureomycin	q.i.d. for 10 days	None
	O.S.	0.2% chloramphenicol	q.i.d. for 10 days	None

CLINICAL TRIAL

Although experimental herpetic infections in rabbits revealed no striking antiviral properties of chloramphenicol, it immediately became evident that the animals tolerated the drug exceedingly well and also that secondary infections cleared rapidly on chloramphenicol therapy. Consequently a clinical trial of the drug in various external ocular infections was begun. Preparations used included the 0.1-percent and 0.2-percent solutions in physiologic saline, which were prepared here, and the 0.5-percent "gelsiccated" solution and 1.0-percent ointment supplied by the manufacturer. Included in this report are 65 consecutive cases with sufficient follow-up to make them of value.

The initial cases had done poorly over a long period of time on various other forms of therapy or had shown repeated recurrences despite previous presumably acceptable treatment. The latter cases were external ocular infections encountered in our outpatient clinic.

All cases had cultures and smears of scrapings from the conjunctival epithelium and the lid margins or, in the case of corneal lesions, from the corneal lesions themselves. Cultures reported as showing no growth were, in many cases, considered suggestive of viral infections. However, no facilities for cultivation of viruses were available. In one instance specific inclusions were found. In cases in which only Staphylococcus albus or nonhemolytic Staphylococcus aureus were found, coagulase determinations were run and are reported.

The frequency of application of the chloramphenicol solutions and ointment was determined by the apparent severity of the infection. Results have been graded as good, fair, or poor, according to the completeness and speed of response as compared to that expected from well-established therapeutic agents. Table 3 reports the findings in this preliminary trial.

Patients repeatedly reported that the drops felt good upon instillation and had a soothing effect on the eye. This is in contrast to patient comment on a majority of solutions already in use. The preparations for topical instillation showed very low toxicity. Nothing suggesting either an allergic or irritative reaction was seen in any case from use of the solutions alone. In four cases (2, 17, 21, and 39) some irritation and redness of the lids resulted from the use of the one-percent ointment. It seems highly probable

TABLE 2

CHLORAMPHENICOL IN HERPES SIMPLEX OF THE RABBIT CORNEA

(Eyes 1 through 6 inoculated and left untreated for three days. Eyes 7 through 18 inoculated and left untreated for four days)

Rabbit Eye No.	Type of Lesion	Drug Used (q.i.d.)	Length of Treatment (days)	Course
1	Fair take. Small ulcer with single vesicle	0.2% chloramphenicol	7	Small vesicle and ulcer cleared completely
2	Good dendritic ulcer	control		Progress to corneal abscess and hypopyon in 5 days. 0.2% chloramphenicol started 5 times a day with complete clearing of all activity in 7 more days
3	Poor dendritic take. Early shaggy secondary infection	0.2% chloramphenicol	10	Serratia, staph. aureus, micrococcus tetrageni, and alpha strep. cultured. Slow, steady clearing in 10 days
4	Poor dendritic take. Early shaggy secondary infection	0.1% chloramphenicol	10	Culture similar to No. 3, and course essentially the same
5	Dendritic ulcer	0.2% chloramphenicol	14	Ulcer became secondarily infected. Cultured hemolytic and non-hemolytic staph. and a hemophilus. Slow clearing of all except linear scar in 14 days
6	Poor take. Only line of scratch	30% sodium sulfacetimide	6	Completely clear in 4 days
7	Shaggy linear ulcer, purulent	0.1% chloramphenicol	19	Conjunctiva clean in 3 to 4 days. Hypopyon in 6 days, cleared after 9 days. Residual bulla after therapy
8	Shaggy linear ulcer, purulent	0.2% chloramphenicol	19	Conjunctiva clean in 3 to 4 days. Slow clearing of corneal ulcer over 14 day period, leaving linear scar
9	Shaggy linear ulcer, purulent	30% sodium sulfacetimide	19	Conjunctiva and secondary infection cleared promptly. Dendritic form remained 14 days, gradually subsided
10	Shaggy linear ulcer, purulent	control for 12 days, 0.2% chloramphenicol	— 10	Rapid progression of intense inflammation to hypopyon. Chloramphenicol started after 12 days; corneal perforation 3 days later, with subsequent gradual clearing to opaque phthisic globe
11	Dendritic ulcer	0.5% aureomycin	11	Remained clean but dendritic form remained until rabbit's death after 11 days
12	Poor initial take, reinoculated with good dendritic ulcer	0.1% chloramphenicol	7	Progression of dendritic ulcer with intense inflammation and ciliary flush, to death after 11 days
13	Dendritic ulcer	0.5% aureomycin	12	Marked edema and infiltrate about dendritic form, with large central opacity after 1 week. Gradual subsequent healing, leaving central leukoma
14	Dendritic ulcer	0.2% chloramphenicol	12	Small linear infiltrate about dendritic form. Never marked reaction and only faint linear scar left
15	Infiltrate with vesicles only in line of scratch	0.5% aureomycin	12	Reaction remained slight and gradually cleared, leaving linear scar
16	Infiltrate with vesicles only in line of scratch	0.1% chloramphenicol	12	Reaction remained moderate. Gradually cleared with moderate scar and some vascularization remaining
17	Infiltrate in line of scratch with small bleb	0.5% aureomycin	12	Opacity gradually increased for 5 days and then gradually cleared, leaving linear scar
18	Infiltrate in line of scratch with small bleb	0.2% chloramphenicol	12	Opacity gradually increased for 5 days and then gradually cleared, leaving linear scar

that this was a reaction to the ointment base, since all three cases showed no further irritation when the ointment was stopped but the solution continued. In one of these cases the ointment was tried again and the irritative symptoms again became evident.

The response of several cases, which had done very poorly on other drugs, appears to indicate that chloramphenicol is a valuable addition to the drugs and antibiotics available for topical use in ocular infections. It is noteworthy that among the previously treated cases were two of recurrent herpetic corneal lesions. An acute dendritic ulcer was not encountered during this initial trial period.

In general, the results given by chloramphenicol in this series appear to be as satis-

TABLE 3

CHLORAMPHENICOL IN CLINICAL CASES

Case No.	Lesion	Culture	Unsuccessful Previous Therapy	Chloramphenicol Therapy	Course	Result
1	Metaherpetic keratitis	Cornea—no growth; Lids—hemolytic staph. aureus; alpha strep.	Sodium sulfacetimide, aureomycin, chemical cauterization	0.1% q.i.d. 0.2% b.i.d. 1% oint. q.n.	Rapid subjective and objective improvement with eventual almost complete clearing of corneal blebs, scarring, and vascularization	Good
2	Chronic ulcerative blepharitis	Hemolytic & nonhemolytic staph. aureus; alpha strep.; pneumococci	Sodium sulfacetimide, staph. toxoid, antiseborrheics	0.1% t.i.d. 0.2% t.i.d. 1% oint. b.i.d.	Marked clearing and subjective relief in 1 week, almost complete clearing in 3 weeks. Recurred later and cleared promptly on 0.2% solution. Irritation from ointment, cleared on solution alone	Good
3	Nummular keratitis	Hemolytic & nonhemolytic staph. aureus; alpha strep.	Sodium sulfacetimide	0.2% q.i.d. 1% oint. b.i.d.	Dendritic keratitis 2 years before. Marked improvement in 1 week and complete clearing in 4 weeks except for faint scarring	Good
4	Ulcerative blepharoconjunct.	Hemolytic staph. aureus	Sodium sulfacetimide, aureomycin, and penicillin	0.1% q.4 h.	After previous severe flareups, cleared completely in 2 weeks and has remained clear	Good
5	Ulcerative blepharoconjunct. & marginal keratitis	Hemolytic staph. aureus; gamma strep.	Sodium sulfacetimide	0.2% q.3 h. 1% oint. b.i.d.	Marked improvement 1 week. Cultured sterile after 4 weeks. Recurred but improved again on solution. Never cleared completely	Fair
6	Subacute follicular conjunct.	No growth	None	0.2% q.i.d.	Complete clearing in 4 days	Good
7	Phlyctenular keratoconjunct. with secondary infection	Hemolytic staph. aureus; alpha strep.; micrococcis tetragenl	Vitamins and local hygiene	0.2% q.i.d.	Multivitamins also given. Dramatic early improvement, but therapy allowed to stop. Recurrence again improved on resumed therapy	Fair
8	Recurrent subacute catarrhal conjunct.	Alcaligenes	Sodium sulfacetimide	0.2% q.i.d.	Prompt relief with complete clearing in 10 days	Good
9	Ulcerative blepharoconjunct.	Hemolytic staph. aureus	None	0.2% q.i.d. 1% oint. b.i.d.	Dramatic improvement in 1 week; only slight seborrheic remnant in 2 weeks	Good
10	Acute catarrhal conjunct.	Hemophilus (not differentiated); hemolytic staph. aureus; paracolon.	None	0.2% q.i.d.	Rapid and complete clearing in 5 days	Good
11	Chronic blepharoconjunct.	Hemolytic staph. aureus	Sodium sulfacetimide	0.2% q.i.d.	Marked improvement in 5 days. Only slight seborrheic remnant in 10 days	Good
12	Marginal keratitis & acute follicular conjunct.	No growth	None	0.2% q.4 h.	Improved in 3 days. Completely clear in 2 weeks	Good
13	Subacute catarrhal conjunct.	Nonhemolytic staph. aureus	None	0.2% q.i.d. 1% oint. q.n.	Greatly improved in 3 days. Cleared in 1 week. Mild recurrence in 1 month. Again cleared promptly	Good
14	Chronic keratoconjunct.	Hemolytic & nonhemolytic staph. aureus	Sodium sulfacetimide	0.2% q.4 h.	Dramatic clearing in 1 week with complete cure in 3 weeks	Good
15	Acute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.i.d.	Very slight improvement in 10 days. Rapid clearing on sodium sulfacetimide	Poor
16	Keratoconjunct. with trichiasis	Nonhemolytic staph. albus; serratia; diphtheroids	Sodium sulfacetimide	0.2% q.i.d.	Conjunctival redness and corneal staining cleared in 2 weeks. Also epilated	Fair
17	Chronic blepharitis	Nonhemolytic staph. aureus, coagulase positive	None	0.2% q.i.d. 1% oint. b.i.d.	Lids sterile in one week. Irritative reaction to ointment. Cleared promptly when solution alone used	Good

TABLE 3—(*continued*)

Case No.	Lesion	Culture	Unsuccessful Previous Therapy	Chloramphenicol Therapy	Course	Result
18	Chronic catarrhal conjunct.	Hemolytic staph. aureus; alpha strep.	None	0.2% t.i.d.	Completely cleared and culture sterile in 1 week	Good
19	Purulent conjunct. in socket	Serratia	None	0.2% q.i.d.	Essentially clean in 1 week. No redness in 2 weeks	Good
20	Recurrent blepharoconjunct.	Hemolytic staph. aureus	Propion ophthalmic	0.5% q.i.d. 1% oint. b.i.d.	Great improvement in 3 days. Cleared in 2 weeks	Good
21	Recurrent mixed blepharitis	Hemolytic staph. aureus	Propion ophthalmic	0.2% t.i.d. 1% oint. b.i.d.	Improved in 1 week. Essentially clear in 2 weeks. Mild irritation from ointment but not solution	Good
22	Chronic ulcerative blepharoconjunct.	Alcaligenes; hemolytic staph. aureus	None	0.5% q.i.d. 1% oint. b.i.d.	Great improvement in 3 days. Flareup after premature cessation of therapy, promptly responded again	Good
23	Mixed blepharoconjunct.	Hemolytic staph. albus, coagulase positive	None	0.5% q.i.d. 1% oint. b.i.d.	Great improvement in 3 days. Only mild seborrheic remnant in 10 days	Good
24	Marginal corneal ulcer	Hemolytic staph. aureus	None	0.5% q.3 h. 1% oint. t.i.d.	Marked improvement in 3 days. Cured after 2 weeks reduced therapy	Good
25	Mixed blepharoconjunct.	Hemolytic staph. albus, coagulase negative	None	0.5% q.i.d. 1% oint. b.i.d.	Objectively clear except for mild seborrhea in 1 week. Little subjective improvement	Fair
26	Epidemic keratoconjunct.	Characteristic inclusion bodies on smear. Nonhemolytic staph. aureus	Sodium sulfacetimide	0.5% q.3 h. 1% oint. b.i.d.	No improvement on chloramphenicol alone. Slow but steady improvement on combined aureomycin, chloramphenicol locally, plus systemic triple sulfonamides. Cured in 3 or 4 weeks	Poor
27	Vernal catarrh with secondary infection	Hemolytic staph. aureus	Sodium sulfacetimide	0.2% q.i.d.	Early slight improvement but relapsed. Did better with sodium sulfacetimide	Poor
28	Blepharoconjunct.	Hemolytic staph. aureus	Sulfonamide	0.2% q.3 h.	Great improvement in 3 days, with cure in 2 weeks	Good
29	Ulcerative blepharoconjunct.	Hemolytic staph. aureus; pneumococci.	None	0.2% q.i.d. 1% oint. b.i.d.	Improved in 1 week. Essentially clear in 2 weeks	Good
30	Acute catarrhal conjunct.	Alpha strep.	None	0.2% q.4 h.	Marked improvement in 2 days. Clear in 1 week	Good
31	Subacute catarrhal conjunct. in socket	Hemolytic staph. aureus	None	0.2% q.i.d. 1% oint. q.n.	Greatly improved in 1 week. Clear in 2 weeks	Good
32	Acute follicular conjunct.	Hemolytic staph. aureus & albus	None	0.2% q.4 h. 1% oint. q.h.	Great improvement in 3 days. Clear in 1 week	Good
33	Marginal keratitis and acute follicular conjunct.	No growth	None	0.2% q.4 h.	Improved in 3 days. Well in 10 days	Good
34	Acute follicular conjunct.	No growth	None	0.2% q.i.d. 1% oint. q.h.	Marked improvement in 5 days. Cleared in 2 weeks	Good
35	Acute catarrhal conjunct.	Hemolytic staph. albus, coagulase positive	None	0.2% q.i.d.	Clear in 4 days	Good
36	Acute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.4 h.	Cleared in 3 days	Good
37	Subacute catarrhal conjunct.	No growth	None	0.2% q.i.d.	Marked improvement in 3 days. Clear in 1 week	Good
38	Acute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.4 h.	Complete clearing in 3 days	Good

TABLE 3—(*continued*)

Case No.	Lesion	Culture	Unsuccessful Previous Therapy	Chloramphenicol Therapy	Course	Result
39	Chronic mixed blepharoconjunct.	Hemolytic staph. aureus	None	0.2% q.4 h. 1% oint. q.h.	Improved in 10 days, but mild recurrenceson reduced therapy. Irritation from ointment, but not olution	Fair
40	Chronic catarrhal conjunct.	No growth	None	0.2% q.i.d.	Marked improvement in 1 week	Good
41	Acute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.4 h.	Striking improvement in 3 days. Slight recurrence in 2 weeks. Cultured alcaligenes. Prompt clearing when drug resumed	Good
42	Acute purulent conjunct.	1-Diphtheroids, 2-Hemolytic staph. albus, congulase positive	None	0.2% q.2 h.	Penicillin (400,000 units combined aqueous-provaine) also given. Marked improvement in 4 days, essentially clear in 1 week. Recurred 10 days later (second culture) with poor response to above therapy. Cleared on sodium sulfacetimide	Poor
43	Subacute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.i.d. 1% oint. q.n.	Marked improvement in 5 days. Mild recurrence in one month	Fair
44	Mixed blepharoconjunct.	Hemolytic staph. aureus	None	0.2% q.i.d. 1% oint. q.n.	Clear except for mild seborrhea in 1 week	Good
45	Acute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.4 h.	Marked improvement in 2 days. Therapy stopped and recurrence developed. Cleared promptly when therapy resumed	Good
46	Subacute catarrhal conjunct.	Hemolytic staph. albus, coagulase negative	None	0.2% q.i.d.	Complete clearing in 1 week	Good
47	Acute catarrhal conjunct.	Alpha strep.; hemolytic staph. albus	None	0.2% q.3 h. 1% oint. q.n.	Marked improvement in 4 days. Complete clearing in 10 days	Good
48	Mixed blepharoconjunct.	No growth	None	0.2% q.i.d. 1% oint. q.n.	Considerable improvement with chiefly seborrheic remnant in 2 weeks	Fair
49	Acute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.4 h.	Slow but steady improvement over 2 week period	Fair
50	Ulcerative blepharoconjunct.	Hemolytic staph. aureus	None	0.2% q.i.d. 1% oint. b.i.d.	Marked improvement in 1 week. Complete clearing in 2 weeks	Good
51	Acute catarrhal conjunct.	No growth	None	0.2% q.i.d.	Improved in 4 days, clear in 2 weeks	Fair
52	Severe catarrhal conjunct. in socket	Hemolytic staph. aureus; gram positive spore former	None	0.2% q.i.d.	Marked improvement in 3 days	Good
53	Subacute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.i.d.	Marked improvement in 3 days. Essentially clear in 1 week	Good
54	Chronic catarrhal conjunct.	No growth	None	0.2% q.i.d.	Marked improvement in 1 week. Clear in 2 weeks	Good
55	Chronic blepharitis and meibomitis	Nonhemolytic staph. aureus; hemolytic and nonhemolytic staph. albus	None	0.2% q.i.d. 1% oint. b.i.d.	Lids improved in 10 days. Glands milked and essentially clear in 4 weeks	Fair
56	Acute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.i.d.	Rapid clearing to cure in 1 week	Good
57	Subacute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.i.d.	Moderately improved in 1 week	Fair
58	Chronic catarrhal conjunct. in socket	No growth	None	0.2% q.i.d.	Marked improvement in 1 week	Good

TABLE 3—(*continued*)

Case No.	Lesion	Culture	Unsuccessful Previous Therapy	Chloramphenicol Therapy	Course	Result
59	Subacute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.4 h.	Moderate improvement in 1 week with slow subsequent improvement	Fair
60	Acute purulent conjunct. in socket	Hemolytic staph. aureus and albus; paracolon	None	0.2% q.i.d.	Marked clearing in 4 to 5 days and remained clear.	Good
61	Ulcerative blepharoconjunct.	Hemolytic staph. aureus	None	0.2% q.3 h. 1% oint. t.i.d.	Very severe infection cleared strikingly in 3 days	Good
62	Subacute catarrhal conjunct.	Hemolytic staph. aureus	None	0.2% q.4 h.	Marked improvement in 5 days. Clear in 3 weeks	Good
63	Mixed blepharoconjunct.	No growth	None	0.2% q.i.d. 1% oint. b.i.d.	Improved in 1 week. Only mild seborrhea after 2 weeks	Good
64	Subacute catarrhal conjunct.	Nonhemolytic staph. aureus; coagulase positive	None	0.5% q.i.d.	Complete clearing in 1 week	Good
65	Acute purulent blepharoconjunct.	Hemolytic staph. aureus	None	0.2% q.3 h. 1% oint. t.i.d.	Marked clearing in 5 days	Good

factory in as great a range of conditions as those obtained with any previously used drug or antibiotic. Although the results in several cases of hemolytic staphylococcal infections were not satisfactory, in other hemolytic staphylococcal cases, chloramphenicol proved effective after other drugs had done poorly. However, it is our impression that hemolytic staphylococcal infections respond somewhat more slowly to chloramphenicol than to 30-percent sodium sulfacetimide.

Summary

1. Chloramphenicol solutions have been found to be easily prepared, stable, comfortable, and nontoxic preparations for topical use in external ocular infections.

2. Chloramphenicol has demonstrated effectiveness against a wide range of bacterial infections in various external ocular inflammatory conditions and has suggested a possible effectiveness against certain viral manifestations.

3. Chloramphenicol appears to be a useful, convenient, and nontoxic addition to our armamentarium of drugs for topical use in ocular infections.

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Addendum

Since this paper was submitted, chloramphenicol has been used topically for treatment in an additional 100 cases of external ocular infections in which cultural studies were done similar to those indicated in Table 3, and also in an approximately equal number of cases in which careful cultural studies were not done.

Results in these additional cases have been comparable to those reported in Table 3 and have led to increasing preference for this drug in the treatment of most external ocular infections in our clinic.

In the more than 200 additional cases, no sensitivity or toxicity reaction to the chloramphenicol solution has been encountered at all, and only two additional cases of an irritative, local toxicity to the ointment have been seen.

Three of these additional cases deserve special emphasis. Two were proved cases of epidemic keratoconjunctivitis from an outbreak in a nearby town, and one patient was seen from the onset of his symptoms. In both cases, chloramphenicol used topically appeared to have no effect at all upon the course of the disorder. The third case

was a severe attack of ophthalmic herpes zoster, which was seen initially on the third day and which was treated by the use of chloramphenicol solution in the eye, chloramphenicol ointment to the lids and skin lesions of the brow, and oral chloramphenicol in dosage of three gm. daily for five days and then two gm. daily for an additional several days. This case showed dramatic improvement within three days after the onset of therapy and within a week was completely cured except for the residual healing skin lesions.

From our experience to date I am unable to appreciate any real advantage of the "gelsiccated" preparation over the simply prepared saline solutions of chloramphenicol.

The assistance of Dr. Walter Dardis, Dr. Dalton Oliver, and Dr. Merritt Whelchel in making this study is gratefully acknowledged.

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THE EFFECT OF GLARE ON THE ACCOMMODATION NEAR POINT*

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Introduction

Most of the work previously done on glare effects dealt with retinal functions, especially with visual acuity.[1,2] It also has been shown that glare produces a pronounced delay in the dark adaptation and increases the speed of light adaptation.[3,4] Dark adaptation is speeded up if the source of glare has an appreciable reduction in the radiations at both ends of the visible spectrum.[3,4]

Glare also may produce lacrimation, conjunctival irritation, blepharospasm, constriction of the pupil, fatigue of the extraocular muscles, and paresis of accommodation, but these effects have not yet been systematically studied.[5]

Livingston[6] found a slight lengthening of the uniocular accommodation near point among the personnel of the British Air Force, most of them between the ages of 20 and 35 years, stationed at Iraq in the month of August when the sunglare is the strongest.

In view of the considerable literature on lens damage produced by excessive light or heat radiation,[1,7-14] the absence of quantitative studies on the effect of glare on lens function is surprising. It was the purpose of this study to provide such data.

Method

Glare was produced by a light bulb within a wood box 18 inches wide, 18 inches deep, and 20 inches long. The light bulb was inserted into a socket in one end of the box and the subject faced the opposite end which contained an eight-inch square opalescent glass window. The subject was seated on a chair with his forehead resting against a small metal support extending horizontally from just above the window in the glare box. With this arrangement the subject's eyes were 7.5 cm. from the glass window. The box was supported on a table at the level of the patient's head.

Because of this arrangement, a direct diffuse type of glare was supplied at each exposure and the glare source subtended a wide

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angle at the eye. Each glare exposure was timed to two minutes.

The intensity of the light at the plane of the eyes of the subjects was 65 foot-candles when a 100-watt light bulb was used and 240 foot-candles when a 200-watt light bulb was used. These intensities were measured with a General Electric light meter.

A Prince's rule with a small rider holding near-point test letters was used for measuring the accommodation near point. Letters were chosen which the subject could easily read at his usual reading distance; the common size being 14/21 or 14/28.

Artificial pupils were used in some of the experiments to rule out the effect of pupillary size on the measurements and also to cut down the amount of light falling into the eye.

A group of 42 younger subjects, between the ages of 20 and 42 years, another group of 36 older subjects between the ages of 49 and 80 years, and a third group of five aphakic subjects between 60 and 78 years of age were used.

The younger group of subjects was composed of student and graduate nurses and resident physicians at the University of Minnesota Hospital. They all had perfect visual acuity, without lenses or with lenses if indicated. The older subjects were all patients in the out-patient eye clinic of the University of Minnesota Hospital. They all had normal or within 10 percent of normal visual acuity for near and far, without lenses or with them when indicated.

The following variations were used: (1) the accommodation near point was determined before and after glare exposure without artificial pupil; (2) the accommodation near point was determined before and after glare exposure with a three-mm. artificial pupil being used during the exposure and all measurements; (3) the accommodation near point was determined before and after glare exposure, with a three-mm. artificial pupil being in place only during the measurements and removed during the glare exposure. In the group of older aphakic subjects, the near point of vision was determined before and after glare with no artificial pupil being used at any time.

For measurement of the accommodation near point, one end of the rule was placed against the infraorbital margin, and the card was advanced toward the eye until the letters became blurred. The point at which the subject first noted blurring was recorded as the accommodation near point. Immediately after this measurement, the glare exposure was given and after that the accommodation near point was measured as before. All measurements were made in triplicate and averaged.

All measurements of the accommodation near point were made in the same room with the subject in the same position before, during, and after the glare exposure and a constant illumination of two foot-candles was maintained in the room.

Results

The results are summarized in Table 1. The statistical significance of the presence or absence of changes of the accommodation near point after glare exposure was calculated from the percentage distribution of the changes (increase, no change, decrease) using Brandt's method,[18] which is based on the t-test. The effect of glare exposure with a 200-watt light bulb on the accommodation near point is compared in a group of younger (first row) and older subjects (second row). No artificial pupil was used.

It can be seen that there is no consistent change of the accommodation near point in younger subjects in contrast to the highly significant ($P<0.01$) lengthening of the accommodation near point in the group of older subjects. The difference in response between the younger and the older group is striking.

Row 3 shows the effect of glare from a 200-watt light bulb on the accommodation near point of younger subjects when a three-mm. artificial pupil was used during measurements and glare exposure. This arrangement rules out the effect of pupillary size on the

TABLE 1

DISTRIBUTION AND STATISTICAL SIGNIFICANCE OF THE CHANGES IN THE ACCOMMODATION NEAR POINT AFTER EXPOSURE TO GLARE, IN PERCENT OF TOTAL NUMBER OF OBSERVATIONS

Age Group (years)	Mean Age (years)	Experimental Arrangement	Total No.	Mean Change	Percent			Statistical Significance
					Increase	No change	Decrease	
22 to 38	23.7	No artificial pupil 200-watt lamp	20	+0.4	25.0	70.0	5.0	No
47 to 80	62.4	No artificial pupil 200-watt lamp	21	+2.4	90.4	4.8	4.8	Highly
20 to 42	28.0	Artificial pupil during glare and a.n.p. meas. 200-watt lamp	11	−0.6	27.3	18.2	54.5	No
20 to 42	26.5	Artificial pupil only during a.n.p. meas. 200-watt lamp	11	+0.5	45.5	27.3	27.2	No
50 to 72	59.2	Increase of a.n.p. with increase of glare from 100 watt with artificial pupil to 200 watt without artificial pupil	10	+2.6	100	0	0	Highly

measurements and cuts down the amount of glare. The results in this group show no consistent change in the accommodation near point.

In a third group of younger subjects the 200-watt light bulb was used as the glare source but the three-mm. artificial pupil was used only during the measurements of the accommodation near point (row 4). The glare effect is here the same as that in the series in Table 1, first row, but the artificial pupil eliminates pupillary size as an experimental variable for the measurement of the accommodation near point. The results show no consistent change of the accommodation near point.

TABLE 2

EFFECT OF GLARE ON THE NEAR POINT OF VISION OF OLDER APHAKIC SUBJECTS
(Glare source: 200 watt. No artificial pupils)

Subject	Sex	Age	Change in a.n.p.
			(in cm.)
F.C.	M.	72	−1.0
N.F.	F.	73	−0.5
K.L.	F.	69	−0.5
A.F.	F.	78	−0.5
M.R.	M.	60	−0.5
Mean		70.4	−0.6

Row 5 shows a comparison of the effects of two different levels of glare on the accommodation near point of a group of older subjects. With the 100-watt glare source, the three-mm. artificial pupil was used during the glare and measurements. With the 200-watt glare source the artificial pupil was used only during the measurements. Thus, the glare effect with the 100-watt glare source was reduced not only by the lower intensity, but also by the decreased area of glare. The two tests were carried out within 10-minute intervals on the same subject.

The results in this group show a slight but fairly consistent lengthening of the accommodation near point after exposure to the 100-watt glare source (mean +0.5) and a very definite lengthening after exposure to the 200-watt source (mean +3.1). The increment (mean +2.6) was statistically highly significant. Therefore, the glare effect on the accommodation near point is quantitatively dependent on the intensity of the glare. The lengthening of the accommodation near point in older people lasted from two to five minutes.

A control group of older aphakic subjects was exposed to glare and the near point of

vision determined before and after glare. A 200-watt light bulb was used as the glare source and no artificial pupil was used at any time (table 2).

Table 2 shows that the near point of vision is very slightly decreased in aphakics after exposure to glare. The absence of a lengthening of the near point of vision in this group is very striking when compared to the results obtained in the older nonaphakic subjects as noted in Table 1.

Discussion

In a large proportion of the subjects and especially in the older ones, immediately after glare exposure, inability to see the test letters at any distance was noted. However, usually within 15 to 30 seconds, they could see the letters previously used at a distance beyond the previously recorded accommodation near point. The temporary change in visual acuity after glare exposure in some of the subjects was no doubt due to a glare effect on the retina.

Since the visual acuity had always been restored to normal before measurements of the accommodation near point were taken after glare exposure, and since the measurements were always performed well above the visual acuity threshold, the changes in the length of the accommodation near point as found in this experimental work cannot be due to a temporary glare effect on the retina. Also, temporary glare effects were observed in both younger and older subjects, while a lengthening of the accommodation near point occurred only in older subjects.

The amount of glare used in these experiments was much less than that used to cause pathologic effects in the lens by Verhoeff and Bell[8] or Burge.[15] It is interesting that physiologic glare effects on the lens can be demonstrated at a much lower level than that necessary to produce apparent pathologic changes.

Ferree and Rand[19] showed that by increasing the illumination from one to five foot-candles, the accommodation near point in nonpresbyopes was decreased two to 25 percent and from 18 to 51 percent in presbyopes. If the illumination was increased from one to 25 foot-candles, the accommodation near point was decreased three to 28 percent in nonpresbyopes and 37 to 75 percent in presbyopes. In their work, however, the illumination was maintained during all the measurements at a constant level which was much lower than the glare intensity used in this work and was not of the type apt to cause glare effects.

It was concluded therefore that the change of the accommodation near point in older people was due to some temporary and reversible change in the lens, and this conclusion is further supported by the absence of changes in aphakic eyes. Since the ultraviolet portion of the spectrum is removed by the glass in any commercial light bulb such as was used here,[8] it may be assumed that the changes observed in older people are due to the heat effect produced by the infrared and visible rays.

The fact that heat effects were observed only in the older subjects agrees very well with the known greater absorption of heat rays in older lenses.[16]

Older lenses may be more sensitive to nutritional changes brought about by heat and the lenses of older people may contain more of the salts[17] which are known to cause an increase in the heat reaction of light on protein.

No gross or slitlamp changes were noted after glare exposure in any of the subjects so examined.

Summary

1. The effect of glare on the accommodation of older and younger subjects was compared.

2. In younger people, no effect was found.

3. In older people, a definite lengthening of the accommodation near point was observed.

4. In older aphakic subjects, no definite or

significant change in the near point of vision was noted after glare exposure.

5. The change in the accommodation near point in older people is not due to a change in visual acuity.

6. The results agree with the known increased absorption of heat-producing rays by older lenses.

7. The results show that heat effects in the lens produced by the amount of glare used in this work produce a functional reversible change in the accommodation of older people. The possible mechanism has been discussed.

Stadium, Gate 27 (14)

ACKNOWLEDGMENT

We wish to thank Dr. Erling W. Hansen, head of the Department of Ophthalmology, for his interest in this study and for his valuable suggestions.

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OPHTHALMIC MINIATURE

(The first note of the pupillary light reflex)

In the middle of the icy humor appears a hole which now dilates and now contracts, according as the icy humor feels the need of light; it contracts when the light is strong, and dilates in obscurity.

Al Razi (Rhazes) *Liber Continens*, 9th Bk. (about 900 A.D.)

ACCOMMODATIVE CONVERGENCE*

EDWIN FORBES TAIT, M.D.
Norristown, Pennsylvania

It has been known for nearly a century that, under certain conditions, accommodative activity in the eyes may act as a stimulus which produces convergence as a response. Through the years, many investigators and clinicians in the fields of physiologic optics and ophthalmology have given more or less consideration to the subject and have developed many concepts of the relationship of accommodation and convergence during the use of the eyes for distance and near fixation.

Donders's[1] original observations, including his experiments on the relative ranges of accommodation and convergence, however, formed the basis of practically all of the subsequent work until the first decade of the present century when the importance of the stimulus in muscular responses began to be appreciated.

In a previous paper,[2] I have presented some of the results of a study of accommodation and convergence responses in terms of the stimuli which produce them. In the case of convergence, it has become fairly evident that, under normal conditions, adequate stimuli for convergence responses may be initiated by either the basic tonic innervational distribution to the extraocular muscles, by the stimulation of the perimacular or extramacular fusional receptors, by the use of accommodation, or by the psychic stimulus resulting from the proximity of the object.

The two reflexes first mention, the tonic convergence and the fusional convergence, are those which are apparently necessary for normal binocular functioning. The remaining two, the accommodative convergence and proximal convergence, are apparently associative in character and unnecessary for the maintenance of comfortable single binocular vision.

The functionally necessary convergence reflexes have been described in a preceding report in this series.[3] In this paper will be presented the results of a statistical and experimental investigation of the accommodative convergence reflex.

Special work in this, up until the present time, has been largely a matter of the presentation and discussion of the incidence and significance of near-point heterophoria findings, which, it will be shown, apparently depend upon the extent or the absence of the accommodative convergence reflex. The more important contributions since Donders are those of Maddox,[4] who presented the concept of physiologic exophoria and suggested the reflex character of the convergence situation revealed by near-point heterophoria measurements, and Sheard,[5] who further developed Maddox's concepts and applied them to the interpretation of the results of the distance and near heterophoria tests, demonstrating that the kind and amount of heterophoria at the near point is mostly dependent upon the accommodative convergence reflex.

Sheard,[6] as the result of further investigations, agreed with Maddox that convergence consists of (1) the tonic condition of the muscles; (2) accommodative convergence; and (3) fusional vergence, and finds that 5$^{\Delta}$ to 6$^{\Delta}$ of exophoria at near must be considered as normal. Weymouth, Brust, and Gobar[7] accepted this viewpoint and developed it further.

In a further study, Sheard[8] makes a distinction between accommodative convergence and physiologic exophoria, but does not develop a mathematical relationship between them.

Cantonnet and Filliozat,[9] in 1934, concluded that there is no necessary propor-

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tionality between accommodation and convergence and that accurate convergence for fixation does not depend upon an accommodative reflex, but upon a fusional process. Later Chavasse[10] pointed out that accommodation and convergence come to be so linked together that eventually the exercise of the one is accompanied by an appropriately corresponding degree of the other, but the second is never entirely adequate. He again does not distinguish between convergence under dissociation and that with binocular fixation.

Davis,[11] in a discussion of accommodative convergence squint, presents the role of accommodative convergence in producing strabismus and suggests that a dissociation of this reflex by suitable orthoptic treatment may make possible binocular fixation without glasses.

Prangen,[12] in a paper upon the diagnosis of heterophoria, states that the amplitude of accommodation should be obtained carefully and any deviation from accepted values should be noted and allowed for in the evaluation of heterophoria, and he also stresses the necessity for considering the fusional vergences and correlating them with the heterophoria, commenting that deviations, particularly for near, are abnormal only when they produce subjective symptoms.

Finally, Davson[13] quotes and agrees with Fincham in believing that any change in the convergence of the eyes produces a change in accommodation, and vice versa, and that the accommodative convergence linkage is not so rigid as to keep the two activities perfectly adjusted.

Previous experimental work in the field of convergence, therefore, and also the results of the present investigation, have shown that variations in the heterophoria findings with fixation at the near point depend upon the amount of accommodation used and the efficiency or activity of the accommodative convergence reflex in any given case.

When clear single binocular vision is present at the near point, it is obvious that the accommodation must be adjusted accurately for the fixation distance and that both visual axes must be directed precisely toward the object of regard. Under these circumstances, there is no question but that the adequate and dominant reflexes are those of fusional vergence and retinal accommodation, the former as a result of the stimulation of the perimacular and extramacular fusional receptors, and the latter as a result of the accommodative response to blurred retinal images.

Under the conditions obtaining during single binocular vision, therefore, the accommodation which is used does not depend upon convergence, nor does the convergence depend upon accommodation. When, however, the fusional vergence reflex is inhibited by fusional dissociation procedures, such as the addition of the 6^{Δ} prism base down over one eye, the convergence is left free to respond to effective stimuli other than those supplied by the fusional mechanisms.

These other stimuli may be the use of accommodation, or the proximity of the object, as pointed out above, or even these may be absent, so that only the tonic vergence is present and the angular relationship of the visual axes for near fixation may be exactly the same as it is for distance. In this latter case, an individual with 60 mm. interpupillary measurement and orthophoria for distance fixation would present 18^{Δ} of exophoria when dissociated with fixation at 33 cm. If, in a similar case, orthophoria for distance, the exophoria were less, or if esophoria were present, the convergence responsible for it would be due either to the use of accommodation or to the proximity of the object.

In actual practice, the proximity reflex rarely accounts for more than a few prism diopters of convergence, so that in practically all instances an increased exophoria at near is due to a lack of the associative accommodative convergence innervation. Accommodative convergence can be demonstrated in most presbyopic cases, and even in bilateral aphakia, which suggests that there is a continued innervation of the ciliary muscle in

such cases, even though an adequate accommodative response is not possible. Apparently, under the latter conditions, a lifetime of ciliary muscle innervational response to retinal blurs builds up a reflex system which cannot easily be inhibited by the inability of a sclerosed lens to respond, or by the removal of the lens.

Experimental work with accommodation and convergence is possible only by the use of subjective methods, thus ruling out, for the most part, animal experimentation. Two types of experimental approach are possible, and both are necessary for an adequate study of the subject.

The first is a determination, by statistical methods, of the distribution of values as found in a large number of visually efficient and comfortable subjects. By comparing any individual findings with the general distribution curve, it can be seen whether or not the individual fits into the range of normal variation. If not, the findings may be diagnostically significant.

The study of the normal distribution in a large group of subjects, moreover, sheds considerable light on the nature of the reflex involved. If the distribution curve is generally broad and even, of a typical Gaussian type, the function which the distribution represents will be, in most cases, dependent upon either anatomic or physiologic characteristics, or upon the existence of a learned reflex.

The second type of experimental approach is that of exhaustive study of the responses of individuals to variable stimulus situations, the subjects being selected from among those who are included in the normal distribution.

By the use of these two methods, a comprehensive picture of the mechanism of the reflex may be obtained, its normal limits determined, and the recognition of abnormalities made possible.

In all such studies, it must be kept in mind that the values of the responses obtained are relative to the stimulus conditions. If other stimuli are used, or other conditions prevail, there will be a variation in the responses, so that in the actual utilization of results in clinical work care must be taken to make them significant by reproducing the experimental conditions as far as possible.

In the present investigation, the first study is concerned with the distribution of heterophoria for distance and near in the case of 4,880 individuals who were ocularly comfortable, who had recently prescribed and satisfactory ametropic corrections if such were necessary, and who were of all ages from 10 to 70 years. The present group was composed of such private and clinic patients and experimental subjects, the latter mostly medical students, medical staff, and hospital personnel, as were available for postrefractive studies.

Lens corrections were worn during the procedures by all who required them, in order to limit accommodative activity to that required for the fixation distance. Thus, for distance fixation, no accommodation above the tonic level was desired or required, while, for near fixation, only that necessary for clear vision at near was used. In the case of the presbyopic individuals, less lenticular response was secured, but, as previously pointed out, the innervation to the ciliary muscle was probably not materially lessened.

For the reasons already presented, statisitical and experimental psychophysiologic methods were employed in this study of the convergence stimulus-response mechanisms. All subjects were screened for individual muscle anomalies by the use of the alternate cover test in the six cardinal positions and by simple tests for single binocular vision and stereopsis, the latter mostly by the use of the lattice-ball stereoscopic slides with and without stereoscopic effect.

The distribution of orthophoria or heterophoria for distance fixation was obtained by producing fusional dissociation with a 6^{Δ} prism base-down over the right eye while fixing a 6/30 "F," black on white translucent background, and with illumination to the extent of 30 foot-candles on the plane of the

TABLE 1

DISTRIBUTION OF ORTHOPHORIA AND HETEROPHORIA FOR DISTANCE FIXATION IN 4,880 OCULARLY COMFORTABLE SUBJECTS

	No. of Cases
Esophoria	
14Δ	3
13Δ	0
12Δ	3
11Δ	3
10Δ	7
9Δ	2
8Δ	20
7Δ	15
6Δ	26
5Δ	31
4Δ	87
3Δ	163
2Δ	327
1Δ	382
Orthophoria	2,331
Exophoria	
1Δ	748
2Δ	436
3Δ	129
4Δ	90
5Δ	21
6Δ	18
7Δ	10
8Δ	11
9Δ	5
10Δ	5
11Δ	1
12Δ	3
13Δ	1
14Δ	0
15Δ	1
16Δ	1

letter. The subject was seated six meters from the test chart with a standard phorometer in front of his eyes and with any needed refractive correction in place.

Several trials for vertical coincidence were made and the results recorded. These were usually repeatable within very narrow limits, but if there was some slight variation, the average of several trials was taken. None of these findings varied greatly.

Inherent in this procedure, of course, was a certain experimental error which had two major components: (1) The variations in the judgment of the individual as to when vertical coincidence of the diplopic images was secured, and (2) variations due to difficulties in reading exactly the calibrations upon the Risley prisms of the phorometer. Repeated trials, however, revealed that the experimental error due to judgment factors was generally less than 1Δ, the average person being able to obtain coincidence repeatedly within a variation of 0.5Δ.

The second major error, that of reading the prism values, was also of about the same amount. In addition, the data from the trials for heterophoria for both distance and near showed a considerable predilection for even numbers where there was a possible choice between uneven and even values in the summation of the readings from the two Risley prisms.

These variations, however, were nonsignificant as far as the data in general were concerned and, in the statistical treatment of the results, a suitable allowance is made for such possible error.

Table 1 presents the actual distribution of orthophoria and heterophoria for distance fixation in 4,880 of these ocularly comfortable subjects. Contrary to expectations, almost half of these individuals presented a practical orthophoria, that is to say were included in the range between 0.5Δ of esophoria and

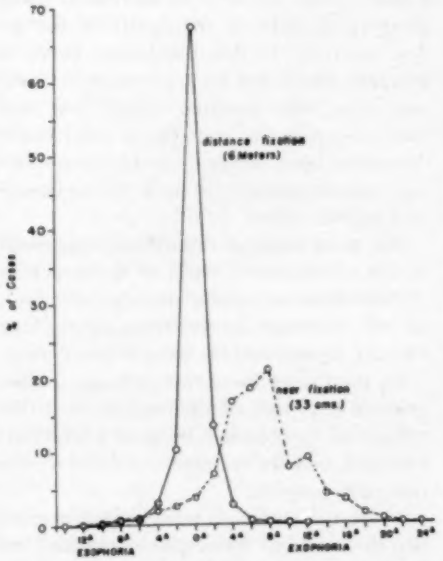

Fig. 1 (Tait). Distribution of heterophoria in 4,880 ocularly comfortable subjects.

TABLE 2

DISTRIBUTION OF ORTHOPHORIA AND HETEROPHORIA FOR NEAR (33 CM.) FIXATION IN 4,880 OCULARLY COMFORTABLE SUBJECTS

	No. of Cases
Esophoria	
16Δ	1
15Δ	1
14Δ	6
13Δ	1
12Δ	11
11Δ	0
10Δ	13
9Δ	6
8Δ	29
7Δ	17
6Δ	32
5Δ	21
4Δ	55
3Δ	58
2Δ	77
1Δ	45
Orthophoria	127
Exophoria	
1Δ	83
2Δ	218
3Δ	212
4Δ	558
5Δ	228
6Δ	704
7Δ	147
8Δ	845
9Δ	129
10Δ	287
11Δ	115
12Δ	314
13Δ	85
14Δ	145
15Δ	51
16Δ	111
17Δ	36
18Δ	52
19Δ	12
20Δ	29
21Δ	4
22Δ	5
23Δ	2
24Δ	5
25Δ	1
26Δ	1
27Δ	0
28Δ	1

0.5Δ of exophoria. The general character of the curve, after the inequalities due to predilection for even numbers were ironed out and the values expressed in percentages, is shown in Figure 1.

The readings were taken as quickly as careful work would permit, in order to avoid the usual slight changes which occur when heterophoria determinations are prolonged and which seem to be due to the subtraction of the fusional impulses from the whole group of afferent impulses which are determining the distribution of tonic reciprocal innervation to the extraocular muscles.

A considerable number of these subjects presented esophoria or exophoria in excess of 3Δ, and yet were comfortable. An examination of the additional data in such cases suggests that the reason for comfort is that the individual possesses an adequate amplitude of fusional vergence with which to modify the reciprocal tonic impulses which are responsible for the heterophoria. While there is but little question as to the validity of this conception, it will not be considered in this present report as the major purpose of the present paper is to examine the factors which are instrumental in producing near-point heterophorias.

Table 2 presents the distribution of orthophoria and heterophoria for 33-cm. fixation in the same subjects, and Figure 1 also presents the general curve of distribution in terms of percentages after experimental and predilection irregularities have been eliminated.

The near-point heterophoria was determined by the same type of dissociation used for distance, namely, a 6Δ prism base-down over the right eye. The fixation object was a small letter "E" measuring three mm. on a side, sufficiently small to demand steady accommodation in order to see it clearly, but sufficiently large so that it could be readily seen by the peripheral retina of the nonfixing eye.

Vertical coincidence of the diplopic "E" was obtained by introducing a suitable amount of lateral prism power. In case of uncertainty or variations, a number of trials were made and the average value secured. There was, however, surprisingly little variation on repeated trials in any of these subjects, the maximum variation being of about 3Δ, probably because excessive base-in prism power was introduced at the beginning of the test and then lessened slowly until the required vertical coincidence was secured.

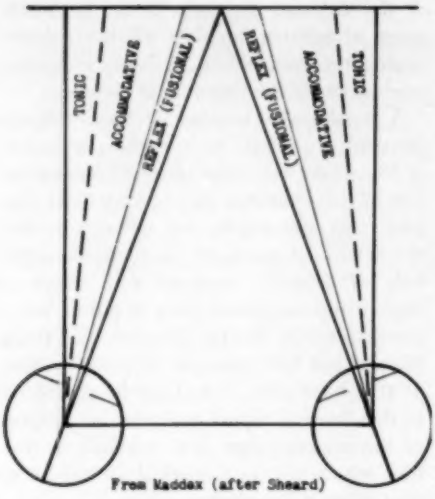

Fig. 2 (Tait). Three grades of convergence with fixation at 13 inches.

An examination of the distribution curve reveals that the greatest number of subjects had from 4$^{\Delta}$ to 12$^{\Delta}$ of exophoria at the near point, with the modal value about 8$^{\Delta}$. There is a very much wider distribution of heterophoria at near than with fixation at distance, the near-point values ranging from an esophoria of 16$^{\Delta}$ to an exophoria of 28$^{\Delta}$. Again keeping in mind that these individuals were all ocularly comfortable, it was evident that the fusional vergence amplitudes were adequate to take care of the excessive values, particularly upon the esophoric side.

While these distributions of orthophoria and heterophoria are interesting in themselves and are examples of the probable character of distribution curves found in any large group of people, the primary purpose in securing them was to calculate from them the value of the accommodative convergence and the distribution of accommodative convergence in the group. For this purpose, it was necessary to know the interpupillary distance in order to calculate the total convergence in prism diopters required to shift the visual axes from parallelism to fixation at one-third meter. The pupillary distance had not been recorded in 87 of the 4,880 subjects, so that accommodative convergence could be calculated accurately in only 4,793.

Accommodative convergence may be defined as the convergence which is the result of accommodative activity when the fusional vergence, which is the normally dominant process, is suspended. As will be shown later, experimentally, heterophoria at the near point is dependent upon the presence or absence of accommodative convergence, except for the possible occurrence of a few cases in which the sense of nearness would give a convergence response in excess of that produced by accommodation. The calculation of accommodative convergence is as follows:

The interpupillary distance in centimeters multiplied by three will give the number of prism diopters of convergence required for the individual in order to turn his eyes from parallelism at distance to fixation at one-third

TABLE 3

VALUES OF ACCOMMODATIVE CONVERGENCE IN 4,793 OCULARLY COMFORTABLE SUBJECTS

Accommodative Convergence	No. of Cases
0$^{\Delta}$	46
1$^{\Delta}$	33
2$^{\Delta}$	70
3$^{\Delta}$	71
4$^{\Delta}$	134
5$^{\Delta}$	108
6$^{\Delta}$	229
7$^{\Delta}$	197
8$^{\Delta}$	265
9$^{\Delta}$	265
10$^{\Delta}$	591
11$^{\Delta}$	308
12$^{\Delta}$	623
13$^{\Delta}$	379
14$^{\Delta}$	471
15$^{\Delta}$	267
16$^{\Delta}$	224
17$^{\Delta}$	122
18$^{\Delta}$	111
19$^{\Delta}$	54
20$^{\Delta}$	32
21$^{\Delta}$	68
22$^{\Delta}$	52
23$^{\Delta}$	18
24$^{\Delta}$	23
25$^{\Delta}$	8
26$^{\Delta}$	11
27$^{\Delta}$	2
28$^{\Delta}$	5
29$^{\Delta}$	1
30$^{\Delta}$	5

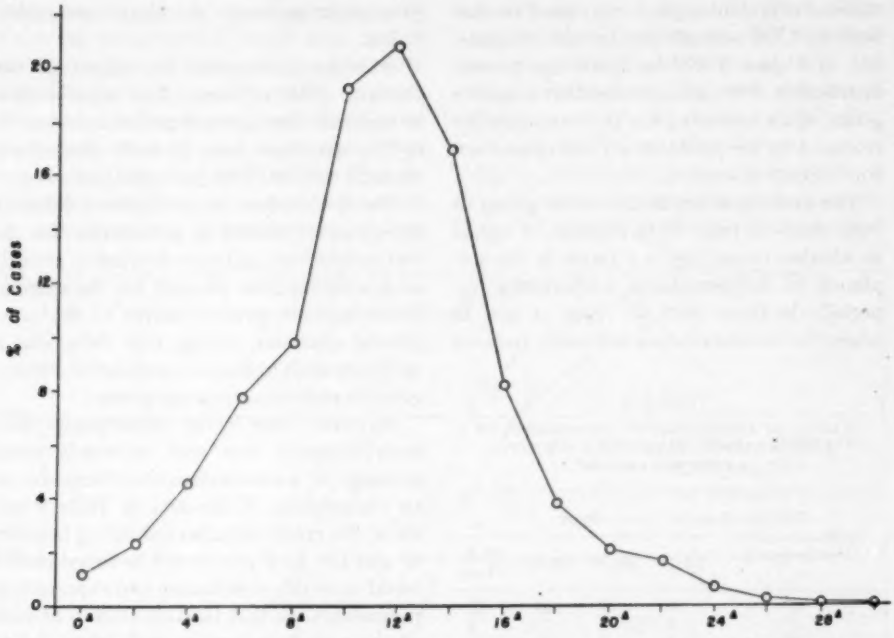

Fig. 3 (Tait). Distribution of accommodative convergence in 4,793 ocularly comfortable patients of all ages.

meter. For an interpupillary distance of six cm., his total convergence, then, would represent six times three, or 18Δ. Where orthophoria is the condition for distance, any failure to converge the whole 18Δ represents that much exophoria at the near point, while any overconvergence beyond 18Δ represents that much esophoria at the near point.

Distance heterophoria will modify these findings according to whether it is esophoria or exophoria, and in order to be able to measure accurately the influence of the accommodation in the convergence status, it is necessary to include the distance heterophoria in the computation. This can be done readily by diagramming it in the manner of Figure 2, or, more conveniently, by utilizing the concept of physiologic exophoria or physiologic esophoria.

In the latter case, if the distance heterophoria findings are subtracted algebraically from the near-point heterophoria findings, the result may be expressed as physiologic exophoria, physiologic orthophoria, or physiologic esophoria. These are not entities in themselves, but merely abstractions which permit the immediate calculation of the accommodative convergence by subtracting the physiologic exophoria or orthophoria from the total convergence from parallelism to the near point, as previously determined, or by adding to the total convergence such physiologic esophoria as is found.

This procedure, which was first presented by me in a previous paper,[3] is carried on as in the following example:

Exophoria 4Δ at distance.
Exophoria 8Δ at 33 cm.

Distance heterophoria subtracted from near-point heterophoria equals 4Δ of physiologic exophoria.

If the patient has 60 mm. pupillary distance, the total convergence will be 18Δ which, minus the physiologic exophoria of 4Δ, equals 14Δ of accommodative convergence.

In Table 3 will be found the values of ac-

commodative convergence calculated on this basis in 4,793 ocularly comfortable subjects, and in Figure 3 will be found the general distribution curve of accommodative convergence, again corrected for the variations introduced by the predilections and clinical errors already discussed.

The question arises in this whole group of individuals of from 10 to 70 years of age as to whether or not age is a factor in the amplitude of accommodative convergence, especially in those over 40 years of age, in whom the accommodation ordinarily requires some extra assistance for clear comfortable vision.

In order to examine this aspect of the problem, 3,900 of these cases were studied in terms of four age groups—those from 10 to 19 years, those from 20 to 39, those from 40 to 59, and those 60 years and over.

The distribution curves in these different age groups, reduced to percentages for direct comparison, and smoothed out in accordance with the plan adopted for the original determinations, present curves of the same general character, except that there was a moderate shift to less accommodative convergence in each successive age group.

However, even in the oldest group there were relatively few with extremely small amounts of accommodative convergence, as an examination of the data in Table 4 will show, the greater number exhibiting between 6^{Δ} and 12^{Δ}. In Figure 4 will be found curves based upon this distribution and expressed in percentages, so that the relationship of each of the various groups to each other and to their own 50 percent position may be determined.

In the presbyopic group, it is quite evident that accommodative convergence is still present despite the individual's inability to focus at near without additional convex lens power. This may be interpreted physiologically as representing a ciliary innervation which, in terms of the number of neurons activated at any given time, would require about the same number of nervous impulses in order to obtain 1.0D. of accommodation as had been previously utilized at an earlier age to obtain 3.0D., such as in the case of an individual of 50 years wearing an add +2.0D., spherical lens. There is probably, in all ages, some innervation of the ciliary musculature and, if the lenticular sclerosis permits, an accommodative response to the accommodative innervation.

In connection with the previous statistical analysis, however, the question may arise as to whether or not the near-point heterophoria is affected or determined by accommodative

TABLE 4

VALUES OF ACCOMMODATIVE CONVERGENCE IN 3,900 OCULARLY COMFORTABLE SUBJECTS IN FOUR AGE GROUPS*

Accommodative Convergence	Ages			
	10–19	20–39	40–59	60 & Over
0^{Δ}	0	5	25	12
1^{Δ}	0	4	13	8
2^{Δ}	1	3	31	20
3^{Δ}	2	4	31	23
4^{Δ}	2	8	65	32
5^{Δ}	1	14	56	21
6^{Δ}	5	23	108	56
7^{Δ}	7	22	87	45
8^{Δ}	15	42	125	39
9^{Δ}	15	33	126	35
10^{Δ}	25	118	241	91
11^{Δ}	30	75	119	30
12^{Δ}	83	162	199	65
13^{Δ}	50	118	109	32
14^{Δ}	86	161	105	23
15^{Δ}	54	102	49	10
16^{Δ}	50	89	36	10
17^{Δ}	35	53	8	2
18^{Δ}	31	40	8	5
19^{Δ}	8	25	8	0
20^{Δ}	19	27	2	2
21^{Δ}	19	14	2	0
22^{Δ}	24	15	6	2
23^{Δ}	7	7	2	0
24^{Δ}	10	9	0	0
25^{Δ}	3	1	0	0
26^{Δ}	6	1	2	0
27^{Δ}	2	0	0	0
28^{Δ}	0	3	1	0
29^{Δ}	0	1	0	0
30^{Δ}	2	2	0	0
Total No. of Cases	592	1,181	1,564	563

*

(Years)	(No. subjects)
10 to 19	592
20 to 39	1,181
40 to 59	1,564
60 and over	563

influences. In order to investigate this possibility, an experimental attack was carried through in 230 of these subjects who were available for such experimentation and who consisted of some private patients, but mostly of medical students and members of the medical and nursing staffs of the Temple University Hospital, all under 35 years of age and all wearing correction lenses if such were needed, so that the accommodation in use could be determined accurately.

The heterophoria for distance and near and the interpupillary distance were determined, as in the previous statistical investigation, and the subjects' accommodative convergence was calculated. Fusional dissociation was then obtained for distance fixation by placing a 6$^{\Delta}$ prism base-down over the right eye.

With the displacing prism in place and with one eye fixing upon the 6/30 "F" on the distance chart, the effect of increased accommodation upon the convergence status was obtained by adding concave spherical lenses binocularly in accretions of 1.0D. The subject's heterophoria was then determined with O.U., −1.0D. sph.; O.U., −2.0D. sph.; and O.U., −3.0D. sph. added in turn.

These concave lenses were then removed and a pair of 1.0D. convex lenses were added. These, of course, blurred the distance chart somewhat but not sufficiently to obscure the fixation letter. The type and amount of heterophoria with each set of experimental lenses was determined by introducing base-out or base-in prisms in order to align vertically the diplopic images.

A similar experimental procedure was then carried on with fixation at 33 cm. upon a small letter "E" which measured four mm. on a side. With 6$^{\Delta}$ prism base-down dissociation, the near heterophoria was first determined with the patient's normal correction, then, successively, with binocular addition of

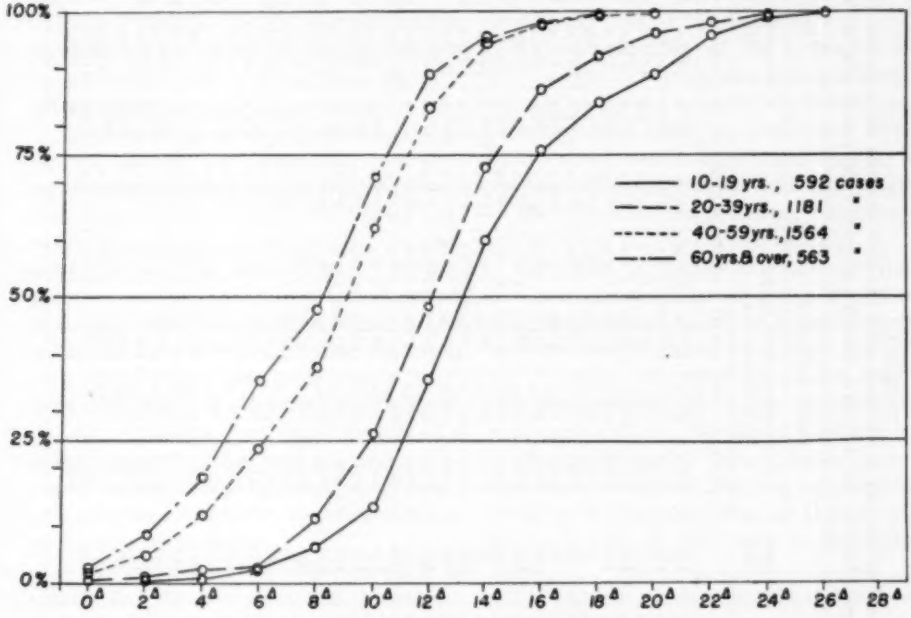

Fig. 4 (Tait). Accumulated distribution of accommodative convergence in 3,900 ocularly comfortable patients within various age groups.

TABLE 5

VARIATIONS IN CONVERGENCE BECAUSE OF CHANGES IN ACCOMMODATION FOR BOTH DISTANCE AND NEAR FIXATION IN 35 SUBJECTS

(Accommodative changes induced by the bilateral introduction of concave and convex spherical lenses.)

No.	Subj.	P.D. In mm.	Heterophoria		Accom. Conv.	Distance Fixation				Near Fixation						
						Heterophoria with Added Spherical Lenses				Heterophoria with Added Spherical Lenses						
			Dist.	Near		−1.00	−2.00	−3.00	+1.00	−1.00	−2.00	−3.00	−4.00	+1.00	+2.00	+3.00
1	M.W.	64	Orth	4Δ Ex	15Δ	2Δ Es	8Δ Es	12Δ Es	Orth	Orth	2Δ Es	5Δ Es	11Δ Es	6Δ Ex	10Δ Ex	14Δ Ex
2	L.H.	60	4Δ Es	4Δ Ex	10Δ	6Δ Es	4Δ Es	14Δ Es	4Δ Es	1Δ Ex	3Δ Es	6Δ Es	8Δ Es	8Δ Ex	11Δ Ex	12Δ Ex
3	I.F.	61	Orth	2Δ Ex	16Δ	1Δ Es	2Δ Es	3Δ Es	Orth	2Δ Es	7Δ Es	12Δ Es	14Δ Es	3Δ Ex	10Δ Ex	16Δ Ex
4	M.Y.	62	2Δ Es	1Δ Ex	15Δ	7Δ Es	10Δ Es	12Δ Es	3Δ Es	2Δ Es	9Δ Es	9Δ Es	10Δ Es	6Δ Ex	10Δ Ex	12Δ Ex
5	G.H.	60	Orth	7Δ Ex	11Δ	2Δ Es	4Δ Es	6Δ Es	Orth	4Δ Ex	2Δ Ex	1Δ Es	4Δ Es	11Δ Ex	14Δ Ex	16Δ Ex
6	J.S.	64	2Δ Es	12Δ Ex	5Δ	2Δ Es	4Δ Es	5Δ Es	2Δ Es	8Δ Ex	6Δ Ex	6Δ Ex	6Δ Ex	14Δ Ex	16Δ Ex	16Δ Ex
7	R.E.	60	1Δ Es	12Δ Ex	5Δ	1Δ Es	2Δ Es	3Δ Es	1Δ Es	12Δ Ex	10Δ Ex	10Δ Ex	9Δ Ex	14Δ Ex	15Δ Ex	16Δ Ex
8	S.S.	62	1Δ Es	10Δ Ex	7Δ	2Δ Es	5Δ Es	8Δ Es	1Δ Es	5Δ Ex	2Δ Ex	1Δ Ex	Orth	11Δ Ex	13Δ Ex	16Δ Ex
9	S.H.	64	4Δ Ex	11Δ Ex	12Δ	2Δ Ex	4Δ Es	6Δ Es	4Δ Ex	10Δ Ex	8Δ Ex	6Δ Ex	6Δ Ex	16Δ Ex	18Δ Ex	22Δ Ex
10	C.B.	62	Orth	2Δ Ex	16Δ	4Δ Es	8Δ Es	9Δ Es	Orth	1Δ Es	3Δ Es	5Δ Es	6Δ Es	5Δ Ex	10Δ Ex	14Δ Ex
11	A.B.	64	Orth	7Δ Ex	12Δ	Orth	2Δ Es	3Δ Es	Orth	3Δ Ex	2Δ Ex	Orth	3Δ Es	7Δ Ex	10Δ Ex	12Δ Ex
12	J.L.	66	1Δ Ex	18Δ Ex	2Δ	1Δ Es	2Δ Es	2Δ Es	2Δ Ex	16Δ Ex	16Δ Ex	16Δ Ex	16Δ Ex	19Δ Ex	19Δ Ex	19Δ Ex
13	B.R.	64	2Δ Es	1Δ Es	18Δ	5Δ Es	10Δ Es	13Δ Es	3Δ Es	4Δ Es	7Δ Es	10Δ Es	11Δ Es	3Δ Ex	4Δ Ex	6Δ Ex
14	R.C.R.	62	2Δ Ex	14Δ Ex	6Δ	Orth	1Δ Es	4Δ Es	2Δ Ex	13Δ Ex	12Δ Ex	11Δ Ex	8Δ Ex	15Δ Ex	18Δ Ex	20Δ Ex
15	M.K.	65	1Δ Es	8Δ Ex	10Δ	4Δ Es	6Δ Es	8Δ Es	1Δ Es	6Δ Ex	4Δ Ex	2Δ Ex	2Δ Ex	10Δ Ex	13Δ Ex	15Δ Ex
16	J.K.	62	2Δ Es	4Δ Ex	12Δ	5Δ Es	8Δ Es	11Δ Es	2Δ Es	Orth	2Δ Es	7Δ Es	10Δ Es	4Δ Ex	8Δ Ex	12Δ Ex
17	C.P.	62	4Δ Es	5Δ Es	19Δ	10Δ Es	19Δ Es	24Δ Es	4Δ Es	11Δ Es	18Δ Es	22Δ Es	24Δ Es	3Δ Es	3Δ Ex	9Δ Ex
18	H.N.	61	1Δ Es	Orth	17Δ	3Δ Es	5Δ Es	5Δ Es	1Δ Es	2Δ Es	3Δ Es	4Δ Es	6Δ Es	Orth	6Δ Ex	13Δ Ex
19	W.K.	66	Orth	5Δ Ex	15Δ	2Δ Es	6Δ Es	9Δ Es	Orth	2Δ Es	4Δ Es	8Δ Es	12Δ Es	8Δ Ex	12Δ Ex	15Δ Ex
20	R.R.	60	Orth	7Δ Ex	11Δ	Orth	1Δ Es	4Δ Es	Orth	4Δ Ex	Orth	2Δ Es	3Δ Es	9Δ Ex	12Δ Ex	13Δ Ex
21	D.C.	59	1Δ Es	Orth	17Δ	2Δ Es	6Δ Es	13Δ Es	1Δ Es	3Δ Es	5Δ Es	12Δ Es	16Δ Es	2Δ Ex	10Δ Ex	14Δ Ex
22	J.M.	62	2Δ Es	6Δ Ex	10Δ	3Δ Es	5Δ Es	8Δ Es	2Δ Es	3Δ Ex	Orth	4Δ Es	8Δ Es	8Δ Ex	10Δ Ex	11Δ Ex
23	A.R.	68	Orth	9Δ Ex	11Δ	1Δ Es	8Δ Es	14Δ Es	Orth	2Δ Ex	10Δ Ex	12Δ Ex	16Δ Ex	9Δ Ex	14Δ Ex	16Δ Ex
24	D.R.	64	Orth	8Δ Es	27Δ	10Δ Es	18Δ Es	23Δ Es	Orth	10Δ Es	16Δ Es	25Δ Es	29Δ Es	4Δ Es	2Δ Es	9Δ Ex
25	G.W.	70	Orth	8Δ Ex	13Δ	2Δ Ex	7Δ Es	12Δ Es	Orth	4Δ Ex	1Δ Ex	8Δ Es	8Δ Es	16Δ Ex	20Δ Ex	22Δ Ex
26	E.C.	62	1Δ Es	2Δ Ex	15Δ	4Δ Es	7Δ Es	9Δ Es	1Δ Es	2Δ Es	5Δ Es	6Δ Es	8Δ Es	2Δ Ex	5Δ Ex	8Δ Ex
27	J.C.	65	Orth	5Δ Ex	14Δ	1Δ Es	2Δ Es	4Δ Es	Orth	1Δ Es	9Δ Es	10Δ Es	10Δ Es	8Δ Ex	13Δ Ex	18Δ Ex
28	J.D.	60	2Δ Es	4Δ Es	20Δ	4Δ Es	11Δ Es	16Δ Es	2Δ Es	7Δ Es	10Δ Es	12Δ Es	17Δ Es	Orth	4Δ Ex	8Δ Ex
29	C.J.B.	67	2Δ Ex	8Δ Ex	14Δ	1Δ Ex	4Δ Es	8Δ Es	2Δ Ex	4Δ Ex	Orth	8Δ Es	10Δ Es	12Δ Ex	19Δ Ex	20Δ Ex
30	A.C.	61	Orth	10Δ Ex	8Δ	2Δ Es	3Δ Es	3Δ Es	Orth	7Δ Ex	3Δ Ex	2Δ Es	3Δ Es	12Δ Ex	16Δ Ex	18Δ Ex
31	E.M.C.	64	5Δ Es	1Δ Ex	13Δ	8Δ Es	11Δ Es	14Δ Es	6Δ Es	2Δ Es	6Δ Es	10Δ Es	14Δ Es	2Δ Ex	4Δ Ex	5Δ Ex
32	J.R.	64	Orth	Orth	19Δ	4Δ Es	8Δ Es	12Δ Es	Orth	1Δ Es	5Δ Es	7Δ Es	8Δ Es	Orth	6Δ Ex	10Δ Ex
33	R.B.	66	2Δ Es	8Δ Ex	10Δ	4Δ Es	6Δ Es	10Δ Es	2Δ Es	5Δ Ex	2Δ Ex	Orth	4Δ Es	10Δ Ex	14Δ Ex	18Δ Ex
34	M.M.	61	2Δ Ex	18Δ Ex	2Δ	1Δ Ex	Orth	2Δ Es	2Δ Ex	15Δ Ex	12Δ Ex	11Δ Ex	9Δ Ex	22Δ Ex	22Δ Ex	23Δ Ex
35	M.A.	63	Orth	4Δ Ex	15Δ	1Δ Ex	2Δ Es	10Δ Es	4Δ Ex	2Δ Ex	Orth	3Δ Es	9Δ Es	12Δ Ex	17Δ Ex	17Δ Ex

concave spherical lenses of values −1.0D., −2.0D., −3.0D., and −4.0D. The heterophoria with each of these was measured by the introduction of suitable lateral prisms to align the diplopic images. Next in order were added convex spherical lenses of values +1.0D., +2.0D., and +3.0D., and the convergence changes measured and recorded in the same way as in the previous determinations.

Table 5 presents the changes produced in convergence by the use of various amounts of accommodation in 35 of these cases, a group which is typical of the whole.

An analysis of the data demonstrates, in general, that if the accommodative convergence value with the subject's normal correction is small, there is little effect upon convergence with any accommodative changes. Conversely, if the accommodative convergence normally is great, a small alteration in the accommodative status of the individual will result in a very considerable change in the angular relationship of the visual axes. This relationship is so nearly invariable in the whole group of cases that if the subject's normal accommodative convergence amplitude is known, it is possible to predict fairly accurately his convergence variation with less or more accommodation.

In this latter series of experiments, it is evident that the only change in the experimental conditions which occurred during the tests was the response of accommodation to changes in the spherical lens values placed in front of the eye. The near-point heterophoria is thus shown to be mostly an expression of the amount of accommodative convergence used under any given set of circumstances.

In view of these experimental findings, it would seem that there would be little question as to the major factors involved in the near point heterophoria findings. These are apparently the tonic vergence balance for distance and the accommodative convergence which is superimposed upon it. Where the tonic vergence balance approximates orthophoria, the near-point heterophoria becomes almost entirely an expression of the extent of the accommodative convergence reflex.

Inasmuch as this reflex is rarely adequate for fixation purposes, being as a rule either inadequate or in excess of the amount to be used at any given point, it is ordinarily superseded by the fusional vergence mechanisms, with the fusional vergence receptors in the perimacular retinal region as the stimulus sources for precise convergence.

An understanding of the nature of the accommodative convergence and its influence on this near-point heterophoria throws considerable light upon the difficulties which have been inherent in classification systems in the past. The most popular and widely used of these has been that of Duane,[14] with some modifications introduced by White.

Ever since 1897, when this new classification was presented, convergence anomalies have been divided into four general groups by those who have used his system. According to Duane, convergence anomalies can be described as either convergence insufficiency, convergence excess, divergence insufficiency, or divergence excess. These diagnostic concepts have been developed and presented in detail by White[15] and others of Duane's pupils, and adhered to in turn by their successors.

This system of classification is based almost entirely upon the motor responses of convergence, and considers only to a very limited extent the stimuli which initiate the observed responses. In view of the widespread use and understanding of the Duane-White viewpoint, however, it is desirable here to discuss its four major groups in terms of the accommodative convergence involved in each.

Following is a summary of the Duane-White classification of convergence anomalies, with the major points of differentiation:

1. Convergence insufficiency:
   (a) Lateral orthophoria or slight exophoria for distance
   (b) Marked exophoria at one-third meter

(c) Pc (near point of convergence) three inches or more from nose
(d) May be accommodative or nonaccommodative
(e) May be secondary to divergence excess

2. Convergence excess:
(a) Orthophoria or moderate esophoria for distance
(b) Marked esophoria at one-third meter
(1) Accommodative convergence excess due to
1. Uncorrected hyperopia
2. Myopia with excessive concave lens correction
3. Beginning presbyopia
4. Cycloplegia
(2) Nonaccommodative convergence excess
(c) May be complicated with divergence insufficiency either as cause or effect

3. Divergence insufficiency:
(a) Primary
(1) Esophoria for distance (not over 8Δ)
(2) Esophoria at one-third meter (small amount)
(b) Secondary
(1) Esophoria for distance great
(2) Esophoria for near greater than distance
(c) May be secondary to a convergence excess

4. Divergence excess:
(a) Exophoria for distance marked
(b) Exophoria at one-third meter less or equal
(c) Primary-convergence normal (Pc normal)
(d) Secondary-convergence less (Pc remote)

The first of these groups, that of *convergence insufficiency*, is marked by the presence of considerable exophoria at the near point. From the reflex standpoint, this means that the patient has only a small amount of accommodative convergence, but, as has been demonstrated previously, it matters little how much accommodative convergence is present in a given case as far as comfort is concerned, unless, of course, it be excessive. The amount of exophoria at near is dependent upon the amplitude of an accommodative convergence reflex which is not in use under normal conditions of fixation. This point was recognized early by Duane, and the position of the near point of convergence was then introduced as a factor in diagnosis.

The convergence near point, of course, depends upon the effectivity of the fusional convergence reflex, and it was properly recognized that in the presence of an adequate amount of fusional convergence, as manifested by a close near point, the individual would be comfortable. An individual with a high exophoria at near, however, would still be classed as a case of convergence insufficiency.

The nonaccommodative character of some of these cases was recognized; for example, that a myope who does not accommodate very much or at all for the near point and who will, in consequence, usually have a marked exophoria. However, it was not realized that the increased exophoria at the near point, under dissociation, was due to the lack of an accommodative convergence reflex.

Convergence insufficiency cases, therefore, can be much more accurately considered on the basis of their tonic vergence balance for distance and the presence or absence of an adequate fusional convergence amplitude. The typical case, showing the reflexes concerned, is illustrated in Figure 5.

The second group, that of *convergence excess*, is represented by those who have a normal or nearly normal tonic vergence balance

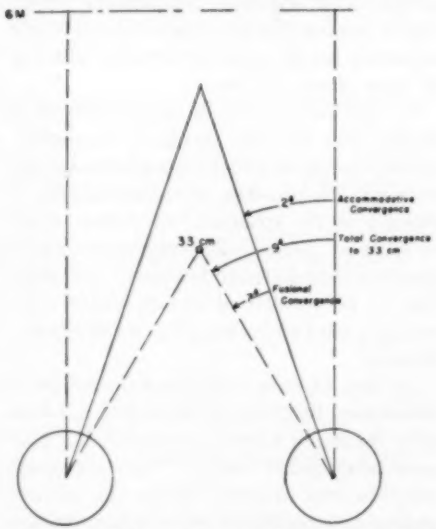

Fig. 5 (Tait). Convergence insufficiency: High exophoria (14Δ) for near with orthophoria for distance (60 p.d.).

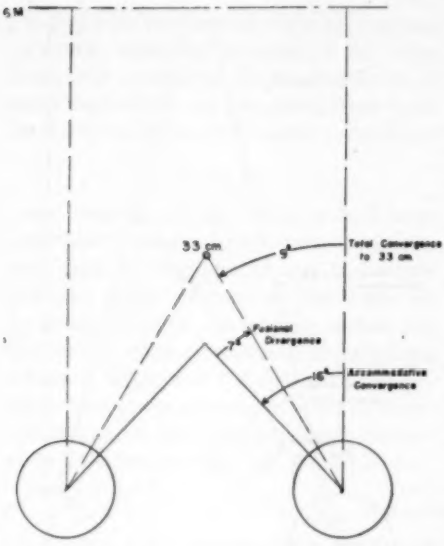

Fig. 6 (Tait). Convergence excess: marked esophoria (14Δ) for near with orthophoria for distance (60 p.d.).

for distance, but who present esophoria at the near point, and is illustrated in Figure 6. These cases are further divided into those in which there is an actual accommodative convergence excess because of uncorrected hyperopia, those presenting a myopia with excessive concave correction, those with beginning presbyopia and straining to see, and those showing the effects of the excessive accommodative convergence innervation occasionally demonstrated by a patient under cycloplegia.

All of these last four groups would, of course, be eliminated if the tests were made with adequate lens corrections for the ametropia present.

Those cases in which the marked esophoria at the near point persists, in spite of adequate ametropic corrections, are considered as the nonaccommodative convergence excess groups. These cases constitute something of a problem when considered only from the standpoint of their motor manifestations. They can be recognized easily, however, by the binocular reflexes, as representing the effect of an exaggerated accommodative convergence reflex. They represent those in whom the normal exercise of accommodation results in an abnormally great associated reflex to convergence, apparently, in most cases, because of the reduction in synaptic resistance or the facilitation of reflexes which often accompanies a generally disturbed nervous system.

The third group, those presenting *divergence insufficiency*, are divided into two subgroups, primary and secondary, which are shown graphically in Figure 7.

The primary group represents those cases in which there is considerable tonic convergence for distance, with a lesser amount of esophoria at one third of a meter. The smaller amount of esophoria at the near point represents, of course, an amount of accommodative convergence well within the usual limits of distribution and the anomaly, therefore, is due to a maldistribution of tonic reciprocal innervation which produces esophoria for distance. If this can be compensated for by an adequate amplitude of fusional divergence, the patient will be comfortable and efficient. If the amplitude of fusional divergence is insufficient, discomfort always ensues and single binocular vision is threatened.

In the secondary divergence insufficiency group, the esophoria at the near point is greater than the amount for distance, this representing not only a tonic convergence innervational fault such as is present in the primary variety, but also an excessive accommodative convergence reflex. Such a case would require fusional divergence, not only for distance, but also at the near point, and this is, in many cases, not available. Practically, of course, the excessive esophoria for near in these individuals could be relieved for the time being, without eliminating the basic cause, by the prescription of added convex lens power for use at the near point.

The fourth and last group, *divergence ex-*

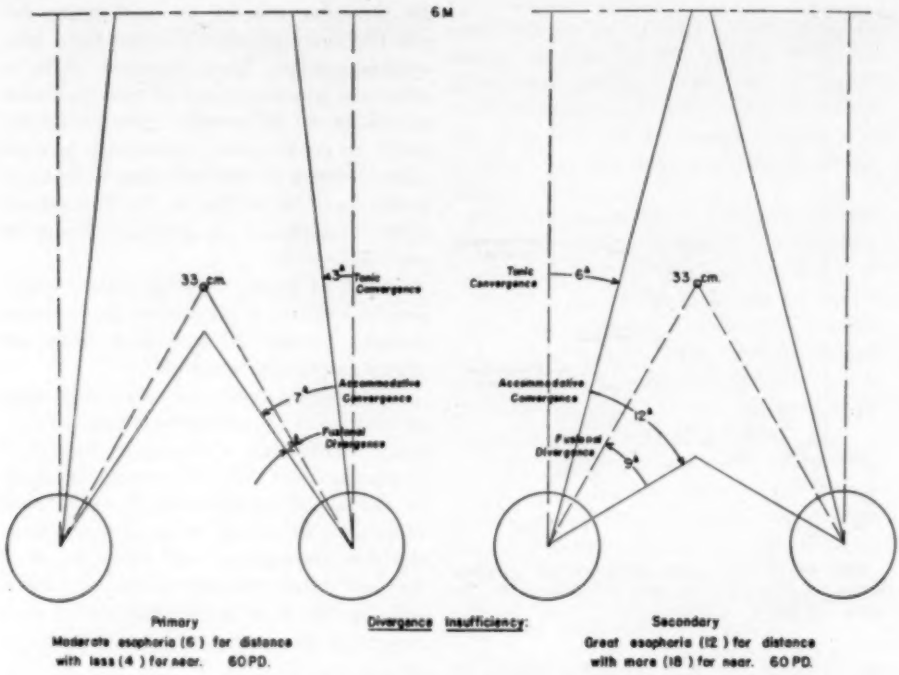

Fig. 7 (Tait). Divergence insufficiency.

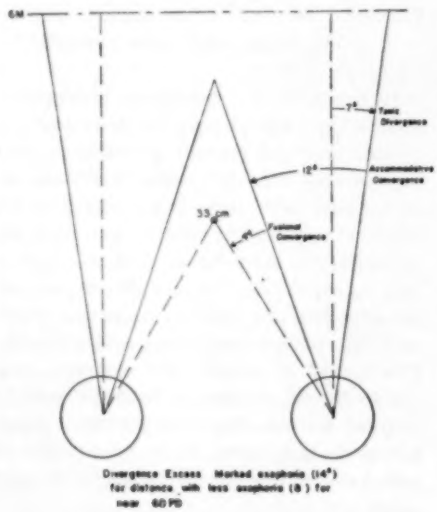

Fig. 8 (Tait). Divergence excess.

cess, represents those cases in which the distribution of tonic reciprocal innervation to the extraocular muscles for distance results in considerable exophoria, with the exophoria at the near point being equal or less than for distance. Comfort in such cases would naturally depend upon the amplitude of fusional convergence, and this is recognized in the classification in that those individuals with a normal convergence near point are differentiated from those with a remote near point. The possibilities for comfort in a given case, of course, depend upon the usable amplitudes of fusional convergence. Figure 8 presents a case of this type.

On the basis of the above, it can be seen that the Duane classification does not result in mutually exclusive groups, because many of the manifest convergence situations upon which it is based must be placed into two or possibly more of the groups. In my opinion,

the practical and precise stimulus-response viewpoint, expressed in terms of the functional and associative vergence reflexes, is much more usable and presents a better basis for the development of corrective procedures.

Summary

An analysis of the distance and near heterophoria status of 4,880 individuals who were ocularly comfortable and had single binocular vision is presented. The nature of the accommodative convergence reflex and the methods of classification of its values are presented, along with the distribution of accommodative convergence, in 4,793 of these.

A study of the accommodative convergence in terms of four age groups is presented, and it is shown that there was some lessening of the values as the ages increased, but that all groups had an appreciable amount of accommodative convergence.

An investigation of the effects of accommodative stimulation and inhibition upon the distance and near point heterophoria values was carried through in 230 subjects. The results indicate that the nature and amount of the near-point heterophoria depend upon: (1) The underlying heterophoria for distance; (2) the amount of accommodation or accommodative innervation present; and (3) upon the extent to which the accommodative convergence reflex is developed and operative in any given individual.

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Ophthalmic Miniature

If a graduated ruler is held at such a distance from the eye that the interval between any given division-mark and the next appears under a smaller angle than one minute, then the sharpest eye can no longer discriminate the two marks from one another.

Robert Hooke, *Transactions of the Royal Society*, 1664.

ROUND-PUPIL CATARACT EXTRACTION*

A COMPARATIVE ANALYSIS

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The present status of the round-pupil or "simple" cataract extraction is comparable to that of the intracapsular extraction of 25 years ago. Currently our large teaching clinics are inclined to prefer the simple extraction with an intact pupil as a routine measure while the "combined" extraction with a complete iridectomy is reserved for those instances in which it is expressly indicated. However, the greater percentage of ophthalmologists continue to regard the round-pupil operation with the cautious reserve formerly associated with the intracapsular cataract operation.

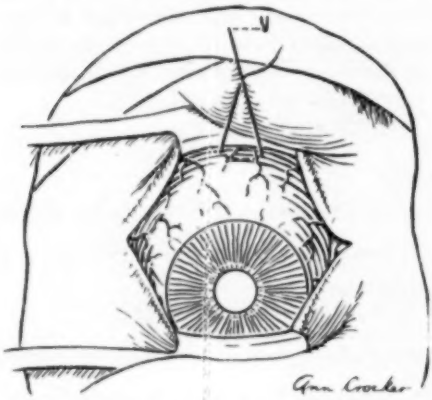

Fig. 1 (Carter). The bridle suture is crossed before passage through the sterile head-dressing. It may then be sectioned distal to the knot so that tension in the suture may be decreased or increased as desired.

An analysis of the results obtained by many surgeons, while making full use of the improved operative procedure, will determine the comparative value of these two methods of cataract extraction. This report of the results obtained in a limited number of consecutive operations may be considered a contribution toward that end.

These factors were taken into consideration in making this analysis: (1) Operative procedure, (2) selection of cases, and (3) comparative operative results.

OPERATIVE PROCEDURE

After van Lint akinesia of the lids and retrobulbar anesthesia with four-percent novocain, a bridle suture is placed in the superior rectus and tied to the sterile head-dressing (fig. 1).

A conjunctival ruff is prepared, five to six mm. in width and concentric to the upper half of the corneal circumference. The entire base of the flap is extended about one mm. into clear cornea by semisharp dissection (fig. 2).

A shallow groove is made in the limbal tis-

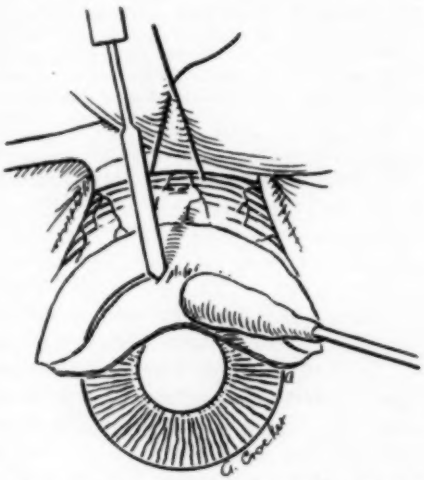

Fig. 2 (Carter). Following dissection of the conjunctival ruff with scissors, the entire base of the flap is extended about one mm. onto the cornea with a Took corneal splitter.

* Read in part before the Detroit Ophthalmological Club, May, 1950.

sue 0.5 mm. from the center of the flap at the 12-o'clock meridian. A double-armed 6-0 black-silk Anacap suture is passed through the groove (fig. 3) from below upward and then as a mattress suture back through the conjunctival flap.

A stab wound of the anterior chamber is made with a needle knife just inside the limbus at the 10-o'clock meridian. The keratome limbal incision is enlarged to one half the circumference with scissors. The corneal flap is lifted by an assistant and a small peripheral iridotomy is made at the 11- and 1-o'clock positions (fig. 4).

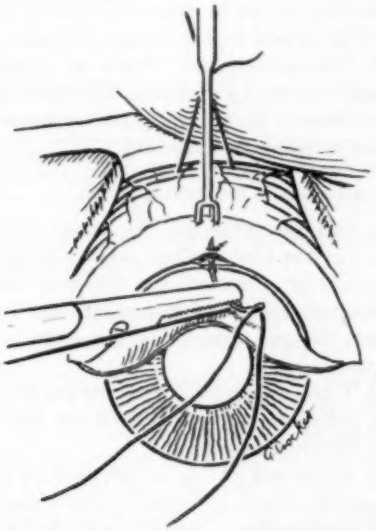

Fig. 3 (Carter). The suture is placed through the limbal groove from below upward, using a Birch corneal pick for fixation of the globe.

The lens capsule is grasped with Verhoeff's half-curved forceps below the anterior pole of the lens. Counter pressure is applied inside the corneoscleral ring with synchronous opposing rotation and lifting of the lens in an arc from the 5- to 7-o'clock position. The intracapsular lens is delivered by tumbling.

The limbal suture is drawn up and tied; the conjunctival wound is closed with a running 6-0 black-silk Anacap suture. Pilocarpine (five percent) is instilled. Iris replacement is seldom required.

The bridle suture and speculum are removed. Air is injected into the anterior chamber by way of the previously prepared stab wound of the anterior chamber (fig. 5). Each eye is covered with a pad and an aluminum shield is placed over the operated eye.

The tenseness of the capsule in an intumescent and particularly in a hypermature cataract is often relieved by a peripheral capsulotomy puncture wound, as first described by Lindner,[1] through one of the basal iridotomies. This permits the escape of fluid or soft lens material and makes it possible to grasp the lens capsule.

If the lens capsule should break, the lens material is milked out as in a linear extraction, followed generally by cautious half-strength normal saline irrigation of the anterior chamber. Pilocarpine is instilled, the wound is closed, and air is injected in the manner already described.

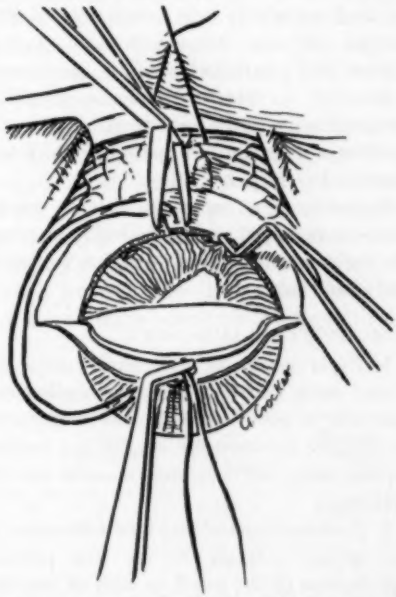

Fig. 4 (Carter). The iris is lifted up in a fold and drawn down with iris forceps, and peripheral iridotomies are made at the 11- and 1-o'clock positions.

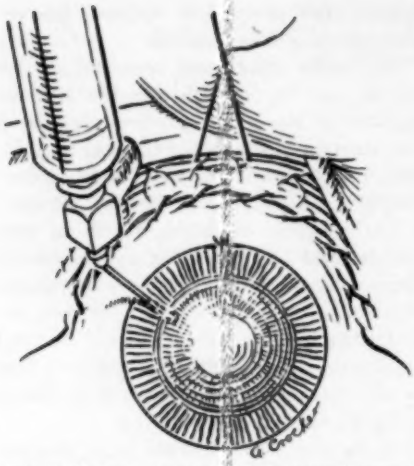

Fig. 5 (Carter). An air bubble is injected through a previously prepared stab wound of the anterior chamber.

Advantages and Disadvantages

Although Daviel[2] (1845-1862) occasionally preferred an iridectomy, the original and accepted procedure was extraction of the cataract through the round pupil. Beer's (Wein, 1806) introduction of his "precorneal iridectomy" in cataract extraction set off a controversy as to the superiority of the one over the other method of operating which has continued to the present time.

Retention of an intact pupil, while recognized as the ideal operation both functionally and cosmetically, is on occasion definitely contraindicated.

Indications for iridectomy

1. *Rigid pupil.* If the pupil cannot be dilated more than five mm., the senile cataract will, in most instances, not conform to the smaller aperture and results in a broken capsule, torn iris sphincter, or even loss of vitreous.

2. *Posterior synechias.* Iris adhesions to the anterior capsule of the lens prevent full dilation of the pupil, as well as creating traction difficulties. Before attempting delivery of the lens, the synechias can be more readily and safely separated by means of spatular manipulations through a complete iridectomy.

3. *Persistent prolapse of the iris.* This complication usually results from a positive vitreous pressure initiated either from within or without the globe. The latter may be corrected by release of the bridle suture, adjustment or removal of the speculum, canthotomy, or a combination of all three.

4. *Dense cortex in pupillary space.* Occasionally a dense cortical plaque remains in the pupillary space following extracapsular extraction. It can be removed with less risk after an iridectomy has been performed.

5. *Vitreous prolapse.* Loss of vitreous usually results in a drawn-up iris, which may later obstruct the corneal pupillary space or result in secondary glaucoma.

Advantages of the round pupil

1. *Optical.* Although the visual advantages in the final analysis are not so great as might be presumed, the diffusion image falling on the retina is smaller, less light enters the eye, accounting for more comfortable vision.

2. *Vitreous barrier.* The intact iris acts as a splint to the vitreous both at the time of and following extraction.

3. *Hyphemia less.* In the presence of sclerosed iris vessels, as found in some diabetics and hypertensive arteriosclerotics, less hemorrhage into the anterior chamber is to be expected.

4. *Instrumentation less.* There is seldom need for replacement of the iris, eliminating to a great extent the use of the iris spatula.

5. *Cosmetic.* Especially desirable in unilateral cataract extractions, otherwise perhaps more often a delight to the surgeon than to the patient.

Selection of cases

Only operations on senile and presenile cataracts were selected for this report. Congenital, traumatic, and complicated cataracts were not included. General disease (diabetes, hypertension, syphilis, and so forth) when

TABLE 1

COMPLICATIONS OF ALL TYPES OF EXTRACTIONS

Number of Operations—256				
Complications			Comments	
Hyphemia	19	7.4%	Blood staining cornea Secondary glaucoma	1 0
Iris prolapse Incarceration	5	1.9%	Sympathetic ophthalmia Secondary glaucoma	0 0
Postoperative glaucoma	5	1.9%	Following vitreous loss Following discission	1 1
Secondary cataract	20	24%	84 extracapsular operations average visual acuity	20/30
Iritis	25	10%	Atropine reaction	9
Vitreous prolapse	19	7.5%	Secondary glaucoma	1
Separation retina	4	1.5%	Vitreous loss	0
Endophthalmitis Expulsive hemorrhage		0%		

properly controlled was not considered a contraindication to operation.

COMPARATIVE ANALYSIS OF 256 CONSECUTIVE OPERATIONS

The operative procedure used was the same in all cases except for the handling of the iris and, more recently, the use of the limbal rather than the scleral type of incision. The preoperative and postoperative treatment and nursing care was that usually provided for private patients. Sulfonamides or antibiotics were administered only when thought to be indicated in selected cases. The results are analyzed in Tables 1 through 7.

DISCUSSION

Objections to the round-pupil extraction have to a large measure been eliminated by almost complete control of the patient's actions during the operation through preoperative sedation, better anesthesia, and the use of the superior rectus suture.

The McLean[3] suture or some form of scleral suturing has eliminated the sandbags and other familiar postoperative restrictions of old, so that now our patient's actions after the operation are of less importance in influencing the final outcome of the operation. Unless we recognize their value and make full use of these newer innovations in cata-

TABLE 2

COMPARISON OF SIMPLE AND COMBINED EXTRACTION

256 Operations	Iritis Uveitis	Vitreous Prolapse	Post-operative Glaucoma	Average Cylinder	Average Visual Acuity
117 Simple ext.	13 (11.1%)	6 (5.1%)	3 (2.5%)	1.85 D	20/23.6
139 Combined ext.	12 (8.7%)	13 (9.37%)	2 (1.5%)	2.43 D	20/25.7
Total Average Percent	25 (9.92%)	19 (6.7%)	5 (2.0%)	2.14 D	20/24.1

TABLE 3

COMPARISON OF INTRACAPSULAR AND EXTRACAPSULAR EXTRACTION

256 Operations	Iritis Uveitis	Vitreous Prolapse	Post-operative Glaucoma	Average Cylinder	Average Visual Acuity
172 Intracapsular	11 (6.4%)	14 (8.2%)	3 (1.7%)	2.33 D	20/23.3
84 Extracapsular	14 (16.6%)	5 (5.9%)	2 (2.3%)	1.93 D	20/29.1
Total Average Percent	25 (11.5%)	19 (7%)	5 (2%)	2.13 D	20/26

ract surgery, the arguments favoring combined extraction should prevail.

Kirby[4] and Wright,[5] both outspoken exponents of the round-pupil extraction, use diametrically opposite methods of lens delivery with equally excellent results. Kirby prefers to slide the lens out by grasping the capsule at the equator near the superior pole. Colonel Wright grasps the capsule near the inferior pole and delivers the lens by tumbling. In most instances the intracapsular extractions reported here were by the tumbling method.

The limbal suture has been found easy to insert, with perfect fixation of the globe afforded by the use of the Birch corneal pick. There were no corneal infiltrations or abscesses as were occasionally encountered with the corneoscleral suture. The fine 6-0 Anacap black silk suture tends to cut through the resistant limbal tissue and is sufficiently loose to provide easy removal on the 14th postoperative day. Indeed, by this time, in some cases, it has already sloughed out without ill effects.

TABLE 4

AVERAGE REFRACTION AND VISUAL ACUITY, 100 CONSECUTIVE OPERATIONS: COMPARISON OF SIMPLE AND COMBINED EXTRACTIONS

Operations—100 Consecutive	Average Cylinder		Average Visual Acuity	
51 Simple intracapsular	1.77	1.69D.	20/20.4	20/27.5
23 Simple extracapsular	1.61		20/34.6	
16 Combined intracapsular	2.80	2.6D.	20/30	20/27
10 Combined extracapsular	2.41		20/24.1	

The limbal section incurs only very little extra time and effort, and, from its limited use thus far, would seem warranted in reducing hyphemia. Vail[6] has shown that most hemorrhages into the anterior chamber have their origin in the newly formed vessels in the corneoscleral wound. The object here has been to make the incision as far into avascular corneal tissue as possible and still have it covered with conjunctiva.

The choice between peripheral iridectomy or iridotomy is slight. That one or the other is an essential leaves little argument. Not only is there less likelihood of iris prolapse in the event of sudden loss of the anterior chamber, but either operation should be insurance against the development of a secondary type of glaucoma as described by Chandler,[7] which might follow occlusion of the round pupil as a result of herniation of the vitreous.

Injection of air forces the vitreous and iris back, immediately reforming the anterior chamber and enhancing the miotic action of

the pilocarpine. Later benefits are seen in the reduced incidence of peripheral anterior synechias and the rare occurrence of separation of the choroid. As the air bubble absorbs by the fifth or sixth postoperative day, it is replaced by aqueous without an interval in which the anterior chamber is flat.

A breakdown of the complications encountered in the course of the 256 operations shows (table 2) that vitreous prolapse is less by 4.2 percent in the round-pupil than in the combined operation.

This would seem to justify the assumption that the iris does in some measure retard an indolent flow of vitreous. On at least three occasions this was seen to occur with distortion of the pupil and uneven depth of the anterior chamber but without apparent incarceration of vitreous in the wound. At other times nothing, and seemingly least of all iris, would hold back an expulsive flow of semifluid vitreous.

TABLE 5

AVERAGE REFRACTION AND VISUAL ACUITY, 100 CONSECUTIVE OPERATIONS: COMPARISON OF INTRACAPSULAR AND EXTRACAPSULAR EXTRACTIONS

Operations—100 Consecutive	Average Cylinder	Average Visual Acuity
67 Intracapsular extractions	2.28D.	20/25.2
33 Extracapsular extractions	2.01D.	20/29.4

Of the five cases of late iris prolapse or incarceration, only one occurred in a round-pupil operation and, in this instance, peripheral iridotomies had not been made. Iritis and postoperative glaucoma were present in a slightly higher percentage in the round-pupil operation.

Hyphemia (table 6) occurred in about the same proportion in both types of operations and is in support of observations made by Vail, Parsons, and others that bleeding from the iris is seldom a cause of hemorrhage into the anterior chamber. Air in the anterior chamber was of no appreciable benefit in preventing hyphemia.

TABLE 6

INCIDENCE OF HYPHEMIA IN ROUND-PUPIL OPERATION AND COMPLETE IRIDECTOMY

Hyphemia—200 Consecutive Cases	
100 Cases Round Pupil	100 Cases Complete Iridectomy
9%	8%

The incidence of hyphemia in the scleral as compared to the limbal type of section (table 7) favored the limbal section but the number of operations was such as to be only suggestive and far from conclusive.

TABLE 7

INCIDENCE OF HYPHEMIA AFTER LIMBAL AND SCLERAL INCISIONS

Hyphemia—100 Consecutive Cases	
50 Cases Scleral Incision	50 Cases Limbal Incision
10%	6%

Monocular round-pupil cataract extractions were done on several patients, who later preferred to continue using the unoperated eye since it still retained good vision. In few of these patients was there even a temporary complaint of confusion or double vision.

Greater glare and aberration in the eye with the large iridectomy of a combined extraction may account for the greater frequency of complaints following this type of operation. According to Cowan,[8] "The size of the diffusion image depends on the size and shape of the pupillary opening and is in direct proportion to the degree of ametropia present."

SUMMARY AND CONCLUSION

End results in 256 cataract operations are tabulated. A comparison is made between the round-pupil and the combined cataract extraction, with discussion of the advantages and disadvantages.

It is concluded that the hazards of the round-pupil cataract operation are not in greater proportion and that its advantages are many.

613 David Whitney Building (26).

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PURTSCHER'S DISEASE*

A REPORT OF TWO CASES

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Purtscher's disease, also known by the descriptive titles retinal teletraumatism, traumatic retinal angiopathy, lymphorrhagia retinae, traumatic liporrhagia retinalis, and angiopathia retinae traumatica, is a clinical entity in which more or less characteristic changes are seen in the fundus following distant trauma. There is still dispute as to the exact pathologic process involved.

The clinical picture is characteristic. Within a matter of hours following trauma to the body, but without directly affecting the eyes, retinal hemorrhages and white patches of exudation develop in one or both eyes, the posterior pole being the site of predilection. The exudates are in the inner layers of the retina and may extend into the vitreous, forming a white cloud which obscures the fundus. The hemorrhages vary in size from minute flame-shaped ones near the veins to massive preretinal hemorrhage.

The exudation is thought by some to be generalized diffusion of fat droplets in the fundus, while others consider it to be merely the escape of plasma from the vessels. The hemorrhages and exudates absorb within weeks or months and, depending upon the severity of the retinal damage, the vision may be permanently impaired or may return completely to normal.

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History

Purtscher, in 1912, first described retinal hemorrhages and whitish plaques occurring in both eyes of a patient following a fall from a roof which resulted in loss of consciousness for six days. He postulated that the changes were due to compression of the spinal column with sudden increased pressure of the cerebrospinal fluid causing an extravasation of fluid into the retina. He called the condition angiopathia retinae traumatica or lymphorrhagia retinae.

Retinal hemorrhages following compression of the thorax and abdomen had been observed long before Purtscher's article. His observations, however, focused attention to the condition and he first postulated as to the genesis.

Since Purtscher's original publication, other theories as to causation have been advanced. These include (1) possible rupture of the thoracic duct with resulting lymphorrhagia, (2) the direct effect of hemorrhages,

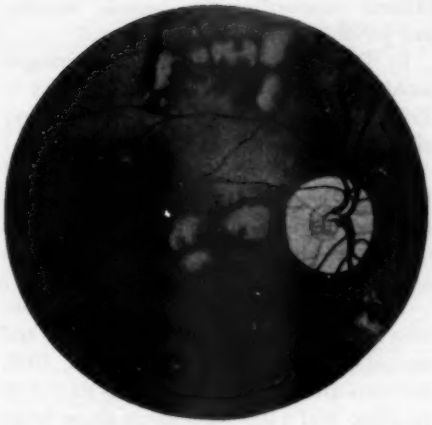

Fig. 1 (Anderson). Fundus drawing (Case 1), showing the typical findings in Purtscher's disease.

(3) a pure inflammatory process, (4) fat embolism, and (5) vasospasm. Of these, the latter two have the greater number of supporters today.

Case reports

The following cases are presented:

Case 1

Mrs. O. C. (101413), a 49-year-old white woman was injured in an automobile accident on October 15, 1948, sustaining fractures of the right clavicle, six ribs on the right and four on the left, multiple contusions of the chest, arms, and face, and mild shock. The following day she complained of marked loss of vision in the right eye.

Examination on October 18, 1948, revealed a normal left eye with corrected visual acuity of 6/6. The right eye was normal externally. Vision was moving objects in the peripheral field. Funduscopic examination revealed clear media, the disc was normal, the veins were full, and the arterioles appeared normal.

In the macular area there was a large preretinal hemorrhage. Another large subhyaloid hemorrhage was present inferior to the macula. Many retinal hemorrhages were present throughout the posterior pole and many fluffy, white exudates were also present. The peripheral fundus was normal. A visual field showed a large absolute central scotoma.

The hemorrhages and exudates gradually cleared and on November 8, 1948, her corrected visual acuity was 1/60. The fundus picture was drawn by the medical artist and the drawing appears in Figure 1.

On December 6, 1948, her corrected visual acuity was 6/6. The exudates had almost absorbed. The macula appeared relatively normal. The large subhyaloid hemorrhage below the macula was smaller and the preretinal hemorrhage above the macula had almost absorbed.

On March 3, 1949, the corrected visual acuity was 6/6 with difficulty on looking between the small scotomas which now appeared on central field examination as shown in Figure 2. The arterioles were beginning to show irregularity in caliber. There was gliosis of the macular area with a loss of

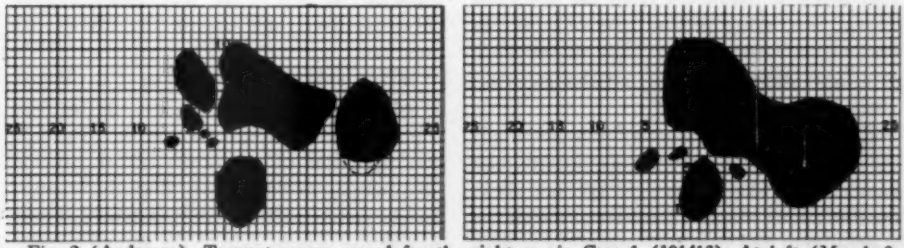

Fig. 2 (Anderson). Tangent-screen record for the right eye in Case 1 (101413). At left (March 3, 1949): Scotomas for 5/1,000 white; can see 1/1,000 white and 2/1,000 red centrally. At right (July 14, 1949): Scotomas for 5/1,000 white.

foveal reflex. All the exudates had absorbed as had all the hemorrhages except the subhyaloid one below the macula along the inferior temporal artery.

By July 8, 1949, the central visual acuity had decreased further to 6/30, although 6/9+ was possible by looking eccentrically. The arterioles showed marked irregularity. There was pigmentary disturbance just temporal to the fovea and some pigment clumping inferior to the macula where the subhyaloid hemorrhage had been present. The hemorrhage had completely absorbed. A visual field showed enlargement of the scotomas as shown in Figure 2. The patient was not seen following this date.

Case 2

R. E. (642081), a 26-year-old white man in good health was in an automobile accident on December 18, 1948, sustaining a simple fracture of the left femur. Examination on December 21, 1948, revealed a normal external ocular examination. There were no ocular symptoms.

Funduscopic examination of the right eye revealed clear media, the disc was normal. Above and below the macula, close to the veins, were several fluffy, white exudates. No hemorrhages were seen. The vessels were grossly normal. The macula and periphery were normal.

Funduscopic examination of the left eye was similar except that there was one granular hemorrhage beneath the inferior temporal vein two disc diameters from the disc. The patient was a myope and glasses were not present; however, he was able to see small print and stated there was no change in his visual acuity.

Examination the next day was essentially the same except that there were two granular hemorrhages seen in the right eye, one above the disc about one disc diameter at the end of a small vein and the other above the macula next to an exudate. The left eye showed a second granular hemorrhage further along the inferior temporal vein next to a white exudate temporally. The vessels, macula, and periphery were otherwise normal.

By December 29, 1948, the hemorrhages were beginning to absorb and on January 5, 1949, examination showed the hemorrhages absorbed and the exudates almost gone.

He was last examined almost one year later on December 9, 1949, at which time the fundi were normal with no changes seen in the vessels or retina. Corrected visual acuity was 6/6+ in each eye.

For the first few days following the accident there was marked disorientation and mental confusion. On December 23, 1948, five days after the accident, he was started on nicotinic acid (100 mg.) every three hours at night and every hour during the day. The first dose was given at 8:00 p.m. and by 12:00 midnight the nurses recorded on the chart that he was rational. Nicotinic acid was continued with steady improvement in his sensorium until it was discontinued on January 2, 1949.

Neurologic examination and skull X-ray studies failed to show any intracranial pathologic condition except for the disorientation and confusion. There was no evidence of external trauma to the head.

Comment

Of the theories advanced as to the causation of Purtscher's disease, fat embolism and diffusion of fat into the retina is most strongly supported by Spaeth. In support of this theory there have been at least three cases reported in which fat was found in the choriocapillaris and also in the retinal circulation.

If fat emboli are the cause, it is difficult to conceive of the globules passing through the pulmonary circulation and then through the capillaries of the retina before causing obstruction. It is known that the hemorrhages and exudates in most instances appear nearer the venous side of the retinal circulation. Also, if diffusion of fat into the retina is the reason for the white patches seen, why should the condition occur unilaterally as it

TABLE 1

TYPES OF FRACTURES AMONG 63 PATIENTS

Type of Fracture	Number Examined	Purtscher's Disease
Femur	16	1
Lower leg (tibia, fibula, patella and ankle)	23	
Arm (humerus, radius, ulna, hand)	12	
Pelvis	5	
Hip (including dislocations)	16	
Ribs, clavicle and scapula	12	1
Vertebras	3	
Skull	2	
Maxilla	1	
Nose	2	
Mandible	2	

Type of Operation	Number Examined
Open reduction of tibia and fibula	2
Open reduction of femur	2
Smith-Peterson nailing	1
Spinal fusion	1
Arthrodesis hip	1
Arthrodesis ankle	1
Iliac graft to radius	1
Osteotomy femur	1
Patellectomy	1
Hemipelvectomy	2

did in Case 1 and others which have been reported?

More reasonable, in my opinion, is the theory of vasospasm as the actual mechanism responsible for the characteristic fundus picture. It is well known that crushing injuries in the body can cause a reflex vasospasm. Such an example is the lower nephron syndrome which was given much attention during the last war. It was shown that constriction of the arterioles in the cortex of the kidneys resulted in a by-passing of the blood flow with resulting oliguria and anuria. It was also shown that the constriction was a reflex vasospasm secondary to crushing injuries.

That the fundus picture could be due to vasospasm is substantiated by the fact that similarly occurring hemorrhages and exudates are seen in arteriospastic retinopathy. As Elwyn points out, hemorrhages and exudates occur in the retina as a result of increased capillary permeability. Such increased permeability can occur in relative anoxia produced by arteriospasm with resultant slowing of the blood flow.

The fact that the patient in Case 2 had mental confusion, indicating some cerebral embarrassment which cleared within a few hours following the administration of vasodilators, suggests that vasospasm is at least part of the picture in Purtscher's disease. The recovery could well be explained on the basis of a reflex vasospasm which was relieved by the administration of vasodilators. When examined, the visible arterioles in Case 2 were normal; however, the smaller precapillary arterioles could have been in a state of reflex spasm which was not visible ophthalmoscopically. The fundus picture was one which could result from such a spasm with resultant slowing of the blood flow and relative anoxia of the capillary walls.

It is also my opinion that, while vasospasm is most likely the actual cause of the hemorrhages and exudates, fat embolism may also play a part in helping produce such a vasospasm. A fat embolus may be responsible for surrounding reflex vasospasm or the vasospasm may be the direct result of trauma without the presence of fat emboli. Vasospasm resulting from fat emboli could account for those cases where fat was found in the retinal circulation of both eyes,[12] while a fundus pathologic process was seen ophthalmoscopically in only one eye.

In order to try to determine the mechanism responsible for the pathologic condition of the fundus, a series of random fracture cases was studied for the presence of pathologic development in the retina. It was hoped that

a case would be found showing a typical ophthalmoscopic picture and then to obtain pathologic sections which could be studied for the presence of fat in the retinal circulation and the retinal exudates.

Two cases were found in a series of 63 fracture patients having a total of more than 90 fractures. Neither case was fatal so that pathologic examination could not be carried out.

Table 1 shows the types of fractures, some of the patients having only single fractures while others had multiple fractures. Also shown are various types of orthopedic surgical procedures in which patients were examined postoperatively for the presence of a possible pathologic change in the retina.

It is well known that there is rather marked liberation of fat from the bone marrow during some of the orthopedic procedures and, if fat in the blood stream is the causative agent for the fundus picture of Purtscher's disease, it is reasonable to assume that there might be found some patient showing a typical funduscopic picture following extensive bone surgery. In the limited number of patients with surgical procedures performed no pathologic condition of the retina was found which simulated Purtscher's disease.

Summary

1. Two new cases of Purtscher's disease are reported, one having characteristic changes unilaterally in the right eye, the other having less marked changes in both eyes.

2. A series of 74 patients was studied for the incidence of Purtscher's disease. These patients had a total of more than 97 different fractures and 13 orthopedic surgical procedures. Out of the series studied two cases of Purtscher's disease were discovered, one being the result of severe crushing injury to the chest and the other due to a simple fracture of the femur.

3. It is believed that the incidence of Purtscher's disease is higher than the literature would indicate, there being only 47 authenticated cases reported up until 1949.

4. It is my opinion that vasospasm with resulting increased capillary permeability and escape of plasma and cells is the mechanism directly responsible for the clinical picture of Purtscher's disease. It is conceded that fat embolism may play a part in some cases in producing such a reflex vasospasm.

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FUNDUS CHANGES IN JUVENILE DIABETICS*

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We are indebted to Dr. Alexis Hartmann and Dr. William Daeschner of Washington University for the use of their data on the general physical and laboratory examinations in this report. They have also provided a grading system to show the degree of control of the diabetes of these patients. They will present the general medical aspects of this study in a separate paper.

Jaeger in 1856 first noted changes in the retina which were associated with diabetes mellitus. In 1890, Hirschberg studied these changes and divided them into various types of retinopathy. For the next few decades no new retinal findings were brought out, and discussion centered around whether these changes were due primarily to diabetes or to arteriosclerosis associated with diabetes.

During this time almost all diabetic retinopathy was seen in the middle-age group; diabetic patients of less than 40 years of age who had retinopathy were considered rare enough to be reported in the literature. After the discovery of insulin and its use in controlling diabetes, there was an increase in the number of reports of retinopathy in juvenile diabetics. However, as late as 1940 Duke-Elder[1] stated that patients under 40 years of age with diabetic retinopathy were exceptional and was able to collect only six reports up to that time. Since 1940, there have been increasing numbers of cases reported, because the erstwhile juvenile diabetics are becoming old diabetics, even if still young in years.

Ballantyne[2] believed that retinal changes in diabetes and in hypertensive disease were separate entities clinically and histologically, the vascular changes in diabetes being mainly venous, while those associated with hypertension were mainly arterial. He stated that microaneurysms seemed to be the earliest pathologic retinal lesion in diabetes. He also said that diabetic retinopathy was uncommon in the very young, his youngest patient being 19 years of age.

Dolger[3] stated that retinal hemorrhage, albuminuria, and hypertension appeared in this group of patients regardless of the age of onset or degree of severity of the diabetes, the need for insulin, or the type of diabetic control. He also wrote that retinal hemorrhage, albuminuria, or hypertension in some degree were found in all 200 of his patients below 50 years of age whom he had followed for 25 years.

Waite and Beetham[4] examined 3,915 diabetics in all age groups and reported an increasing incidence of deep retinal hemorrhages with the increasing duration of diabetes.

Givner and Lodyjensky[5] examined 128 juvenile diabetics between five and 19 years of age, only 10 of whom had had their diabetes longer than 10 years, and found retinopathy consisting of capillary aneurysms and pin-point hemorrhages in only three cases.

Anderson[6] stated that the duration of diabetes rather than its severity governs the time of onset of retinal changes. He suggested that if the diabetes could be perfectly controlled, retinal and vascular changes might be prevented altogether.

White and Waskow[7] reported 387 juvenile diabetics whose diabetes was of 20 or more years' duration. They reported that no eyes without arteriosclerosis showed retinal hemorrhages, but some of these patients showed no albuminuria or hypertension. Dilated veins and capillary microaneurysms were

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common in these patients; 85 percent had retinal arteriosclerosis; 75 percent had retinal hemorrhages; 55 percent had hypertension; 40 percent had albuminuria. Of 220 juvenile diabetics who had received poor treatment for at least 50 percent of their diabetic lives, 93 percent had demonstrable vascular disease.

Ricketts[8] stated that diabetic retinopathy occurring in juvenile and adult diabetics correlated only with the duration of the disease.

Jackson[9] and his co-workers reported 75 cases of juvenile diabetes. In half of the patients the duration of the disease was over 15 years, in 11 over 20 years. Their treatment was based on the premise that a diabetic child has a normal propensity for health as long as the diabetes is well controlled. Their level of control was based mainly on the presence or absence of sugar in the urine. Retinopathy was present in 46.4 percent of their patients, hypertension in four percent, and albuminuria in four percent. They concluded from their study that both the level of control and the duration of disease are significant factors in the development of degenerative changes in juvenile diabetics. They believed that good control delays and may possibly prevent serious degenerative changes. Degenerative changes in the eye were found more frequently than any other type of lesion in the patient, and in only one patient was it possible to demonstrate other vascular damage when none was found in the eye.

Method of Study

An analysis of our findings in 59 juvenile diabetics is presented. Any patient whose diabetes was diagnosed before the age of 15 years is considered in this paper to be a juvenile diabetic. All patients in this report were followed by the Departments of Pediatrics and Medicine at Washington University from the onset of their diabetes and no outside cases are included. An analysis of the outpatient and hospital records was made and a complete interval history was taken for this study. A thorough physical examination was made and pertinent laboratory procedures were performed. Each retina was examined following dilatation of the pupils with neosynephrine.

The grade of control was estimated by using 100 for perfect control and deducting points for periods of acidosis after the onset of diabetes, episodes of hypoglycemia, severe intercurrent infections, prolonged periods of glycosuria, and deviations from normal of height and weight.

The grade of present physical condition was determined by using 100 as perfect and making deductions for the following: renal pathology as shown by albuminuria, increase over normal of casts and red blood cells in the Addis count, inability to concentrate the urine, and elevated blood nonprotein nitrogen; elevation of blood pressure above normal; increased petechial count in the skin; and poor general condition as shown by enlarged liver, absent dorsalis pedis artery pulsation, and degenerative skin changes. Retinopathy was excluded from the grading of physical condition for this paper as a correlation is made between retinopathy and general physical condition.

Findings

Our findings indicate that poor control of the diabetes, as well as the duration of the disease, is a very important factor in the development of retinopathy, kidney damage, and poor general health.

Examination of our findings in 59 juvenile diabetics shows 54 percent with retinopathy. Only two patients with diabetes for as long

TABLE 1

Method of Grading Retinopathy

Minimal	1–20 microaneurysms or pin-point round hemorrhages.
Moderate	More than 20 microaneurysms or pin-point round hemorrhages; superficial retinal hemorrhages; moderate or large deep hemorrhages
Advanced	Any of above plus evidence of arteriosclerosis, retinitis proliferans, vitreous hemorrhage, glaucoma or rubeosis iridis

TABLE 2

DURATION OF DIABETES COMPARED TO EYE FINDINGS

Number in Group	Duration of Diabetes (in years)	Eye Findings (expressed as percent of normal)
20	4–10	95
18	11–14	74
21	15–27	35

as 15 years had normal fundi. One man, aged 27 years, with a 25-year duration of diabetes had no retinopathy; one nine-year old boy with diabetes for only four years had early diabetic retinopathy.

hemorrhages, and/or moderate or large-sized deep hemorrhages. Advanced retinopathy contains the above, plus any of the following: arteriosclerosis, retinitis proliferans, or vitreous hemorrhage. Cases with rubeosis iridis or glaucoma are also included in the last group. A normal retina was given a grade of 100 and deductions were made as follows: 33⅓ for minimal retinopathy, 66⅔ for moderate retinopathy, and 100 for advanced retinopathy.

Table 2 compares the duration of diabetes with retinopathy. The 21 diabetics having 15 to 27 years' duration of disease had an average retinal grade of 35. The 18 cases in the 11- to 14-year group showed an average grade of 75. The 20 cases in the 4- to 10-year group showed an average of 95. This indicates a definite increase in the severity and incidence of retinopathy with the duration of the diabetes.

TABLE 3

RELATION OF DIABETIC CONTROL TO RETINOPATHY

Number in Group	Duration of Diabetes (in years)	Percent of Control	Retinopathy Given as Percent of Normal	
			80–100% Control	46–79% Control
20	4–10	91	X*	X*
18	11–14	87	Number 14 Control 91% 83%	Number 4 Control 74% 42%
21	15–27	74	Number 9 Control 86% 56%	Number 12 Control 65% 19%

* The group of 4- to 10-year diabetics could not be analyzed.

Table 1 grades retinopathy as minimal, moderate, and advanced.

The minimal grade includes cases with one to 20 microaneurysms or small pin-point hemorrhages. The moderate grade includes cases with more than 20 microaneurysms or pin-point hemorrhages, superficial retinal

Table 3 demonstrates pertinent findings by

TABLE 4

RELATION OF DIABETIC CONTROL TO PHYSICAL CONDITION

Number in Group	Duration of Diabetes (in years)	Percent Control of Diabetes (in percent)	Percent Physical Condition (in percent)	Physical Condition of Group 80–100% Controlled	Physical Condition of Group 46–79% Controlled
20	4–10	91	97	X*	X*
18	11–14	87	89	14 Cases 92%	4 Cases 78%
21	15–27	74	69	9 Cases 79%	12 Cases 61%

* Could not be analyzed. Too few findings.

TABLE 5

RELATION OF RETINOPATHY TO KIDNEY DAMAGE

Retinopathy	Kidney Damage (in percent) Based on Albuminuria, Addis Count, Concentrating Ability, Blood N.P.N.
Normal	4
Minimal	10
Moderate	26.8
Advanced	54.4

separating the patients with a good grade of control (80 to 100) from those with poor control (46 to 79). In the 15- to 27-year group the well-controlled cases have an average retinal grade of 56, while those in the poorly controlled group have a grade of 19. Similarly in the 11- to 14-year group there is an average retinal grade of 83 in the well-controlled group and 42 in the poorly controlled group. It is interesting that eye findings were considerably more severe in the poorly controlled 11- to 14-year group than in the well-controlled 15- to 27-year group.

These findings indicate a definite variation in retinopathy depending not only upon the duration of the disease, but also upon the control of the diabetes.

Table 4 shows that the grade of general physical condition varies with the duration and control of the diabetes. The average grade of physical condition of the 4- to 10-year group is 97, that of the 11- to 14-year group 89, and that of the 15- to 27-year group 69; these figures correspond closely with the average grade of control in these groups.

If these groups are again separated into patients with well-controlled (80-100) diabetes and poorly controlled (46 to 79) diabetes, we see that the physical condition follows the grade of control closely. In the 15- to 27-year group the well-controlled patients have an average physical grade of 79, the poorly controlled a physical grade of 61. In the 11- to 14-year group the well-controlled cases have a physical grade of 92, the poorly controlled group a grade of 78. The well-controlled cases in the 15- to 27-year group had slightly better physical condition than the poorly controlled cases in the 11- to 14-year group.

TABLE 6

RELATION OF INSULIN DOSAGE TO RETINOPATHY

Number in Group	Units of Insulin Dosage	Average Eye Findings (expressed as percent of normal)
21	20– 60	49
18	61–112	59

Note: These figures are for the age group 11 to 27 years. In the 4- to 10-year group, the case findings were too few to analyze.

Table 5 correlates the degree of kidney damage with the eye findings. Normal was graded 100 and deductions were made for renal pathology as previously described. The cases with normal fundi showed an average of four-percent kidney damage; the group with minimal retinopathy had an average of 10-percent damage; the group with moderate retinopathy had 26.8-percent damage; and the cases with advanced retinopathy had 54.4-percent damage. This indicates a close correlation between the vascular changes noted in the fundi and the amount of kidney damage.

TABLE 7

RELATION OF PETECHIAL COUNT TO RETINOPATHY

Number in Group	Retinopathy	Average Petechial Count (normal, 0–10)
27	None	5
16	Minimal	21
6	Moderate	39
10	Advanced	46

Table 6 correlates retinopathy with the amount of insulin required for control. Cases requiring 20 to 60 units of insulin a day show an average retinal grade of 49, while the average of cases requiring 61 to 112 units daily is 59.

Correlation of petechial counts with retinopathy in Table 7 shows a definite increase in capillary fragility with an increase in dia-

TABLE 8

EYE FINDINGS IN RELATION TO SEVERAL FACTORS

Case Number	Eye Findings*	Grade of Control	Grade of Present Physical Condition	Petechia Count	Duration of Disease (years)	Present Age	Amount of Insulin Taken Daily	Kidney Function Graded as % of Normal
1 M.H.	+++	54	70	30	26	38	80	100
2 M.M.	+++	63	51	70	24	33	45	60
3 J.L.	+++	65	70	65	15	25	49	0
4 M.D.	+++	66	29	50+	20	30	40	0
5 W.H.	+++	66	40	35	21	32	70	66
6 R.W.	+++	66	51	125	15	19	27	40
7 S.M.	+++	68	60	35	18	25	50	
8 E.D.	+++	73	90	4	18	27	70	
9 D.F.	+++	80	79	9	25	36	90	
10 A.S.	+++	88	51	40	26	39	40	60
11 C.R.	++	62	70	20	27	41	65	
12 J.H.	++	67	86	30	14	27	99	100
13 A.B.	++	70	51	44	11	23	36	
14 M.S.	++	72	50	100	26	29	44	40
15 V.R.	++	78	86	15	13	23	92	
16 C.D.	++	88	70	22	14	22	30	80
17 H.W.	+	46	60	20+	22	29	30	
18 E.S.	+	79	90	14	12	18	60	
19 N.S.	+	82	90	15	11	21	60	100
20 M.S.	+	83	70	25	17	23	50	60
21 E.H.	+	83	70	18	17	29	80	80
22 F.B.	+	84	70		14	25	80	60
23 D.T.	+	84	100	5	23	35	50	100
24 J.J.	+	87	79	50+	11	17	100	
25 L.D.	+	87	70	100	21	35	31	100
26 L.B.	+	87	86	35	26	37	60	
27 G.T.	+	87	100	8	12	19	62	100
28 A.S.	+	92	86	30	17	31	54	100
29 P.J.	+	92	100	2	10	21	40	
30 R.H.	+	92	100	0	4	9	42	
31 A.S.	+	96	100	0	12	18	72	100
32 J.D.	+	96	100	8	9	18	100	100
33 J.T.		75	100	3	7	18	97	100
34 H.P.		76	90	5	25	27	80	80
35 J.D.		78	90	25	10	19	80	100
36 C.D.		80	100	0	7	11	37	80
37 F.G.		83	90	5	8	19	90	100
38 H.M.		87	100	2	10	16	30	80
39 I.M.		87	100	7	9	19		100
40 W.C.		88	90	5	14	18	90	
41 L.A.		88	100	6	11	17	100	100
42 V.J.		92	90	22	15	20	72	100
43 C.L.		92	90	4	7	16	40	80
44 L.W.		92	100	0	16	18	50	100
45 J.J.		92	100	6	10	17	60	100
46 J.S.		92	100	2	7	11	40	100
47 E.R.		95	86	3	4	14	140	100
48 Y.R.		96	90	6	10	14	112	80
49 J.K.		96	100	6	7	10	48	100
50 G.D.		96	100	5	9	21	38	100
51 J.S.		96	100	4	13	19	45	100
52 F.K.		96	100	3	11	12	24	
53 C.S.		96	100	0	13	15	57	100

TABLE 8—*Continued*

Case Number	Eye Findings*	Grade of Control	Grade of Present Physical Condition	Petechia Count	Duration of Disease (years)	Present Age	Amount of Insulin Taken Daily	Kidney Function Graded as % of Normal
54 R.H.		96	100	0	11	14	112	100
55 R.H.		96	100	0	8	17	74	100
56 J.H.		96	100	0	10	12	45	100
57 C.M.		100	90	2	10	12	44	100
58 A.P.		100	100	0	14	15	80	100
59 R.P.		100	100	0	10	16	59	100

* +++ = Advanced retinopathy.
++ = Moderate retinopathy.
+ = Minimal retinopathy.

TABLE 9

DURATION OF DIABETES IN RELATION TO EYE FINDINGS, CONTROL, AND PHYSICAL CONDITION

Case Number	Duration (years)	Eye Findings*	Grade of Control (percent)	Grade of Present Physical Condition (percent)	Case Number	Duration (years)	Eye Findings*	Grade of Control (percent)	Grade of Present Physical Condition (percent)
11 C.R.	27	++	62	70	27 G.T.	12	+	87	100
10 A.S.	26	+++	88	51	18 E.S.	12	+	79	90
1 M.H.	26	+++	54	70	31 A.S.	12	+	96	100
14 M.S.	26	++	72	50	13 A.B.	11	++	70	51
26 L.B.	26	+	87	86	19 N.S.	11	+	82	90
9 D.F.	25	+++	80	79	24 J.J.	11	+	87	79
34 H.P.	25		76	90	52 F.K.	11		96	100
2 M.M.	24	+++	63	51	41 L.A.	11		88	100
23 D.T.	23	+	84	100	54 R.H.	11		96	100
17 H.W.	22	+	46	60	29 P.J.	10	+	92	100
5 W.H.	21	+++	66	40	56 J.H.	10		96	100
25 L.D.	21	+	87	70	48 Y.R.	10		96	90
4 M.D.	20	+++	66	29	38 H.M.	10		87	100
8 E.D.	18	+++	73	90	59 R.P.	10		100	100
7 S.M.	18	+++	68	60	35 J.P.	10		78	90
28 A.S.	17	+	92	86	57 C.M.	10		100	90
21 E.H.	17	+	83	70	45 J.J.	10		92	100
20 M.S.	17	+	83	70	32 J.D.	9	+	96	100
44 L.W.	16		92	100	50 G.D.	9		96	100
3 J.L.	15	+++	65	70	39 I.M.	9		87	100
6 R.W.	15	+++	66	51	37 F.G.	8		83	90
12 J.H.	14	++	67	86	55 R.H.	8		96	100
16 C.D.	14	++	88	70	33 J.T.	7		75	100
22 F.B.	14	+	84	70	43 C.L.	7		92	90
58 A.P.	14		100	100	46 J.S.	7		92	100
42 V.J.	14		92	90	36 C.D.	7		80	100
40 W.C.	14		88	90	49 J.K.	7		96	100
15 Y.R.	13	++	78	86	30 R.H.	4	+	92	100
51 J.S.	13		96	100	47 E.R.	4		95	86
53 C.S.	13		96	100					

* +++ = Advanced retinopathy.
++ = Moderate retinopathy.
+ = Minimal retinopathy.

TABLE 10

DAILY INSULIN INTAKE IN RELATION TO EYE FINDINGS

Case Number	Amount of Insulin Taken Daily (Cases of 11 to 27-yr. Duration)	Eye Findings*
54 R.H.	112	
41 L.H.	100	
24 J.J.	100	+
12 J.H.	99	++
15 V.R.	92	++
9 D.F.	90	+++
40 W.C.	90	
21 E.H.	80	+
22 F.B.	80	+
34 H.P.	80	
58 A.P.	80	
1 M.H.	80	+++
31 A.S.	72	
42 J.J.	72	
5 W.H.	70	+++
8 E.D.	70	+++
11 C.R.	65	++
27 G.T.	62	+
18 E.S.	60	+
19 N.S.	60	+
26 L.B.	60	+
53 C.S.	57	
28 A.S.	54	+
7 S.M.	50	+++
20 M.S.	50	+
23 D.T.	50	+
44 L.W.	50	
3 J.L.	49	+++
2 M.M.	45	+++
51 J.S.	45	
14 M.S.	44	++
4 M.D.	40	+++
10 A.S.	40	+++
13 A.B.	36	++
25 L.D.	31	+
16 C.D.	30	++
17 H.W.	30	+
6 R.W.	27	+++
52 F.K.	24	

* +++ = Advanced retinopathy.
++ = Moderate retinopathy.
+ = Minimal retinopathy.

betic retinopathy. A circle one inch in diameter was marked on the forearm two inches below the elbow crease. The blood pressure cuff was inflated to a point half way between the systolic and diastolic blood pressure and kept at this level for five minutes. The petechiae in the circle were counted 30 minutes later. The normal petechial count using this method is 0 to 10. Patients with normal fundi in our study had an average petechial count of five. The average case with minimal retinopathy had 21 petechiae, with moderate retinopathy 39 petechiae, and with advanced retinopathy 46 petechiae.

DISCUSSION

In these 59 cases it is noteworthy that the grade of control as well as the eye findings and general health became progressively worse the longer the duration of the disease; there were more opportunities through the years for these patients to develop severe infections, hypoglycemia, and other troubles to which a diabetic is susceptible. However, it is evident that the patient who was able to maintain good control showed evidence of less pathologic progress than the one whose diabetes was poorly controlled.

This should serve as a stimulus to the diabetic and the physician who is caring for diabetics to attempt to keep a normal blood chemistry and to treat both minor and major complications early and thoroughly. Our study indicates that a perfectly controlled diabetic can go through a normal life-span with a minimal number of degenerative changes resulting from the diabetes.

The most common degenerative change found in this series of diabetics is in the vascular system of the retina. We found that capillary aneurysms and small round hemorrhages were the first changes to be seen. These were usually found in the area between the superior and inferior temporal vessels. The very early lesions were visible only on careful examination.

CONCLUSIONS

1. In juvenile diabetics the control of the diabetes, as well as the duration of the disease, is an important governing factor in the development of retinopathy, kidney damage, and poor general physical condition.

2. In juvenile diabetics examination of the retina is a fairly reliable method of determining the amount of kidney damage and the condition of the vascular system in general.

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BOECK'S SARCOID*

A REVIEW AND A REPORT OF A CASE DEMONSTRATING MULTIPLE IRIS NODULES, ACUTE SECONDARY GLAUCOMA, AND KERATOPATHY

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Boeck's sarcoid is generally considered to be a chronic, relatively benign, granulomatous systemic disease of unknown etiology which may involve the skin, bones, lung, lymphatic system, eyes, and parotid and lacrimal glands. It is characterized by progressive tendencies and spontaneous remissions (Duke-Elder).[9] Probably 75 percent of the cases are not serious.

Clinically, in spite of the generalized involvement, there is usually a lack of symptoms. Fever, weight loss, pain, and chest symptoms are occasional complaints.

In a select group of cases from a chest clinic, Reisner[6] found a nonproductive cough and dyspnea in 50 percent. Of 32 cases hospitalized at Hines Veterans Administration Hospital, five (16 percent) gave a history of dyspnea or chest pain, and three (9.5 percent) had fever.†

Other names for this disease are sarcoidosis, Besnier and Schaumann's disease, Mylius-Schürmann's disease, benign lymphogranulomatosis, pseudotuberculosis, and paratuberculosis. Gilbert (1940) reviewed Heerfordt's uveoparotid fever and Mikulicz's syndrome and suggested that most of the cases diagnosed as uveoparotid fever and some diagnosed as Mikulicz's syndrome were Boeck's sarcoid. The disease simulates tuberculosis and many still believe it is an atypical form of tuberculosis.

Review

History

Boeck (1899) first described microscopically the skin lesion, although his uncle made pictures of the lesions prior to 1869 when Hutchinson first published a case. In 1889, Besnier called it lupus pernio. Kienbock (1902) described the cysts in the bones of the fingers. (Jungling, in 1919, again described the bone lesion.) Heerfordt (1909)

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† From the records of Hines Hospital.

noted involvement of the uveal tract and parotid gland.

In 1914, Schaumann and others showed it to be a widespread disease syndrome and demonstrated the histologic relationship between the skin and the bone lesions. In 1924, he related all the characteristics of sarcoid into one disease syndrome.

Distribution

Boeck's sarcoid is usually seen in younger adults—male or female. The onset cannot be determined because marked changes may be present before any symptoms occur. It is not rare. Nevertheless, of 450,000 registrations at the University of Chicago Clinics, Gifford and Krause[8] found only 30 recognized cases of Boeck's sarcoid. The eye was involved in 10 of these 30 cases, while in eight, the ocular symptoms were noted first. The patient is generally in good general health and he has few clinical symptoms. It is seen most frequently in Negroes.

Most cases are discovered through X-ray studies of the chest, although the cutaneous manifestations, the ocular manifestations or an occasional fever may be the first indication.

Histopathology

The typical lesion is a granuloma made up of nodules—each nodule composed of epithelioid cells among which are lymphocytes and occasional Langhans giant cells. The epithelioid cells are organized in clusters. Caseation and acid-fast organisms are absent. Healing is by fibrosis and hyalin replacement or by return to normal.

In skin lesions, about which skin pathologists[6] do not always agree, there are fewer lymphocytes and the epithelioid cells are arranged in whorls surrounded by connective-tissue fibers. In lymph-node lesions, there are more lymphocytes and giant cells than in the skin but they are not surrounded by connective-tissue fibers.

Theories as to etiology

A. *Atypical tuberculosis.*[1] The negative tuberculin reaction is explained as being due to the formation of substances which neutralize tuberculin. The advocates of this immunity theory call it a state of anergy.

Sweany[1] listed points against this theory: (1) The tuberculin reaction is negative; (2) very few acid-fast bacilli have been shown in the lesions (Kyrle, however, claimed that, if an attempt is made to grow bacilli when the lesion first shows up, acid-fast organisms can be found); (3) it has never been transmitted to animals; (4) practically no case has been reported which was due to exposure to another case; (5) it is rare in the tropics where tuberculosis is common.

The following points have been made in favor of the atypical tuberculosis theory:

1. It is also difficult to find the bacilli in many tuberculous lesions.

2. Sweany said that, in some sarcoids, the lesions show transition phases which cannot be distinguished from tuberculosis. It was noted that, in tuberculosis, the tuberculin reaction decreases gradually in severity as the bacillary content decreases and as the caseation decreases.

3. There are reports of sarcoids showing tubercle bacilli.

4. Leider[2] states that Lemming showed that subjects who had once been tuberculin-positive and later become anergic to tuberculin (cases of sarcoid) could not be sensitized to tuberculin by means of BCG inoculations. However, subjects who had always been tuberculin-negative, could definitely be sensitized to tuberculin with BCG.

5. Some think Boeck's sarcoid may be due to a filterable type of tubercle bacillus; this is hard to disprove. A review of the autopsied cases of sarcoidosis showed one, reported by Pinner and Rubin,[3] of a Negress whose mother died of tuberculosis and who at the age of 13 years had X-ray evidence of pulmonary pathologic lesions and a positive Mantoux test. After several normal preg-

nancies, she developed uveoparotid fever. A cervical node biopsy was diagnosed sarcoidosis and her Mantoux test now became negative.

At autopsy, the lung showed caseation, and both Boeck's nodules and tuberculous areas were shown microscopically. The liver contained acid-fast organisms and guinea-pig inoculations were positive. The lymph nodes showed no acid-fast organisms.

Pinner and Rubin[3] referred to a case, reported by Berlinger, of a 25-year-old man, in whom the nodes showed no caseation. However, when the material was injected into guinea pigs and on second transfer, typical inoculation tuberculosis was produced.

Pinner and Rubin[3] felt that caseation can occur in sarcoidosis.

Of the 26 autopsied cases, eight showed caseation; they felt it either due to secondary infection with tuberculosis or sarcoidosis.

B. *A virus*, and C. *Nonspecific reaction.* Most authors believe a specific virus or a nonspecific reaction of the body tissues to a number of agents is the cause of sarcoidosis.

Curtis and Grekin[4] pointed out cases in which the areas injured by glass later developed the sarcoid response. They refer to Ray and Shipman as showing that lipins of tubercle, of liver, grass, and colon bacilli, when injected into the skin of guinea pigs produced an epithelioid reaction; to Anderson as finding that the alcohol-soluble lipoids contained phosphorus and were phosphatides; and to Sabin as injecting phosphatides from tubercle bacilli into guinea pigs and producing epithelioid reactions.

Silica, when injected intratracheally, produced increased epithelioid response and phospholipids in the lungs. These silica-free phospholipids, when reinjected, reproduced the epithelioid response.

Curtis and Grekin,[4] therefore, feel that there is evidence that the disease is a "foreign-body response" to phospholipids which can be found in microörganisms or which may be stimulated by foreign-body substances. (Michelson doubts that these localized lesions and generalized sarcoidosis are the same.)

In reviewing the hospitalized cases of Boeck's sarcoid at Hines Hospital, one case was found in a soldier who had received multiple powder burns of his hands and thigh from a land mine (1944). He developed subcutaneous nodules on the dorsum of the hands which slowly increased in size. Biopsy of a papule showed "foreign-body reaction with pseudotubercles," while biopsy of an epitrochlear node showed Boeck's sarcoid.

Tissues involved

A. *Lymph Nodes.* According to Schaumann, the lymph nodes are involved in all cases. The peripheral nodes are moderate in size, firm, rubbery, discrete, movable, and usually painless. The most frequently affected are the epitrochlear, cervical, submental, preauricular, postauricular, and axillary. The inguinals may also be involved. The mediastinal nodes are frequently enlarged, as is seen by X ray. They were shown to be present in 30 of 35 proved cases.

B. *Skin.* Sweany says that 40 percent of the cases show skin involvement at some time or other. Of 32 cases at Hines Hospital, only three (9.5 percent) showed skin involvement.

The usual lesions are painless, small, reddish-blue papules, 1.0 to 5.0 mm. in diameter and usually involve the face, extensor surfaces of the arms and legs, and the trunk. Itching is not present. The skin is dry, scaly or crusting. Another form is the subcutaneous larger nodule (Darier-Roussy).

The papules may occur along the margin of the eyelids. Harrell[7] found this location in five out of 11 cases and points out that this is very important since this site is infrequent in other skin diseases.

C. *Lungs.* In a review of 35 proved cases from a chest clinic, Reisner[6] found 30 to have lung changes. Sweany[1] saw a very high percentage of lung involvement in a chest

hospital. The changes noted are peribronchial fibrosis extending into the lower lobes, and soft reticular infiltration more marked near the hilus and medial side of the lower lobes. The apexes are spared. The increased shadow at the hilum is due to hilar nodes. Some cases may resemble miliary tuberculosis.

D. *Bones.* Although the frequency of bone involvement is generally given as 10 to 25 percent, many reports do not approach this incidence. At Hines Hospital, only two out of 32 cases (six percent) presented bone findings.

The findings are cystlike areas or a latticelike appearance near the ends of the shafts of the phalanges and heads of the metacarpals. Although no limitation of motion occurs, fusiform, nontender swelling of the fingers may occur. No periostitis and no joint involvement is present (King[8]). Reisner[6] suggests that microscopic examination might show more involvement of the marrow.

E. *Viscera.* The liver and spleen may be enlarged. Sweany[1] says the spleen is enlarged clinically in 33 percent of the cases. Snapper[21] says liver puncture revealed the sarcoid in 39 of 46 patients.

F. *Ocular tissues and adnexa.* In a series of 100 cases of Boeck's sarcoid summarized by Levitt,[9,14] 43 showed involvement of the ocular area. Of these, 28 demonstrated uveitis of which 23 cases showed bilateral uveitis. Ten cases ended in phthisis bulbi (seven of them bilaterally).

Reisner found the eyes and adnexa involved in 25 percent of 35 cases. At Hines Hospital, five out of 32 cases (16 percent) had eye findings, four of which showed anterior uveitis.

1. Lids. As mentioned, when lid margins are involved in a skin disease, Boeck's sarcoid should be considered at once for lid involvement is rarely seen in other diseases.

Kravitz[10] presented a case suggestive of recurrent chalazion. The mass extended backward into the orbit. The pathologist first called it tuberculoma—then Boeck's sarcoid. As far back as 1917, Derby and Verhoeff[39] described a lesion of the lid, biopsied in 1913, which showed the tubercles of Boeck. Kaplan[20] also described a lesion of the lid with an unusual precipitating factor.

2. Lacrimal gland. Walsh,[11] in 1939, showed cases of bilateral swelling of the lacrimal glands in which histologic sections showed sarcoid infiltration.

Stallard[12] described a case of unilateral lacrimal-gland swelling associated with lymphadenopathy, splenomegaly, and mediastinal changes.

Cullom and Goodpasture[13] presented a case of bilateral swelling of the lacrimal glands associated with extreme weight loss and marked swelling of the turbinates with complete nasal obstruction. After removal of the tumors, the weight loss was regained and the nasal condition cleared.

Sniderman[28] described a case of bilateral involvement of the lacrimal glands associated with bilateral iridocyclitis.

3. Conjunctiva. Conjunctival lesions are supposed to be rare but 20 cases have been reported according to Levitt.[14] (One case involved only the conjunctiva.) Lesions vary in size from pinhead to bean, and are discrete or confluent. The color is gray or yellow-brown.[14] The lesions are firm, painless, and moveable.

Cases have been reported resembling Parinaud's conjunctivitis. Folk[18] described a beefy-red palpebral conjunctiva with hyperplasia. Round masses of granulation tissue extended out from the fornices.

4. Cornea. According to Osterberg[18] and Levitt,[14] corneal lesions are rare. The latter said these lesions, when present, are overshadowed by the uveal lesion and the descemetitis.

Thornhill and Thornhill[16] reported a case in a child showing superficial amorphous deposits in the lower half of the cornea and at the temporal and nasal limbus (in addition to cystic nodules in the iris and fatty keratic precipitates).

According to Cogan, *et al.*,[17] Meesmann first reported band-shaped opacities of the

cornea and conjunctival opacities following overdosage with dihydrotachysterol, for hypoparathyroidism. They reported 19 cases of band-shaped keratopathy, two of which showed sarcoidosis, in which superficial corneal and conjunctival deposits were seen.

In 18 of these 19 cases, there was hypercalcemia. The findings were glasslike crystals in the conjunctiva and diffuse superficial corneal opacities in the palpebral fissures. The corneal opacity was concentric with the limbus and separated from it by a clear zone. Nephrocalcinosis was present in several of the cases.

Cogan brought up the question as to whether the mechanism of the deposit is the same in the cornea as in the renal tubules. Vitamin-D poisoning was believed to be the cause in some of the cases.

The case of Boeck's sarcoid herein reported demonstrates similar superficial corneal deposits. Others have described involvement of the stromal tissue.

5. Uvea. As mentioned, 28 percent of a series of 100 cases showed uveitis. Osterberg[18] found iritis in 27 (5.4 percent) of 500 cases of Boeck's sarcoid. Most of these cases, however, came from dermatologic papers. Blegvad[20] said 10 percent of cases of Boeck's sarcoid had uveitis.

Guyton and Woods[19] found Boeck's sarcoid is the cause in 0.05 percent of iridocyclitis. (Tuberculosis is the cause in 50 percent.) However, they stated their study was actually of little value in determining the true incidence of uveal disease due to Boeck's sarcoid, since their attention was not drawn to the ocular findings in this disease until late in the study.

Levitt[14] describes the usual lesion as a painless chronic plastic iridocyclitis, associated with very little pericorneal injection, marked descemetitis, anterior-chamber flare, multiple posterior synechias, and frequently iris nodules. The lesion is usually bilateral.

Chronic involvement can be expected after either an acute or slow onset. The time of onset of the uveal lesions is not related to the onset of the other manifestations. It can be the first sign. King[8] found it first in six of seven cases.

It should be pointed out that the ocular involvement can be painful and the vision defective enough for the patient to seek medical help even though the chest and skin lesions are not painful.[5]

According to Blegvad,[20] the typical iris nodules are large, irregular in contour, less proliferative, and red-yellow in color. Interlacing fine vessels are limited to the nodules. When the nodules are absorbed, the surface of the iris returns to normal.

Kindt[21] said the nodules are grayish or gray-red and more sharply defined against the iris than in tuberculosis. Osterberg[18] described a case with multiple nodules of the iris, bulging of the adjacent sclera, corneal anesthesia, and vision of 2/60. After 13 months, the nodules were absorbing. In three years, the vision improved to 6/12. Finally all the nodules disappeared.

Levitt, quoting Blegvad, said that the tuberculous nodules tend to be smaller, less defined, gray to light yellow, and smooth surfaced. When the vascularization involving the surrounding iris tissue is absorbed, the iris shows atrophic areas. The choroid may be involved.

6. Retina. Chorioretinitis and retinal periphlebitis have been reported. Walsh[11] described whitish-yellow masses tending toward perivascular localization. He thought it characteristic of intraocular sarcoid. Levitt[14] described a case with horizontally oval soft white spots along the retinal veins.

Goldberg and Newell[22] reported two cases in which a proliferative mass overlay the retina and neovascularization was present. Periphlebitis and both retinal and preretinal hemorrhages were noted.

Papillitis associated with uveitis and papilledema or atrophy associated with intracranial involvement have been reported. Walsh[11] described involvement of the pituitary area with the clinical picture of diabetes insipidus in addition to the uveitis, bilateral

optic atrophy, and pituitary defects in the visual field.

7. VITREOUS. In a recent article, Landers[23] described spherical gray-white opacities, ranging in size from dots to one-third disc diameter in size, present in the dependent portion of the vitreous, and arranged like a "string of pearls." He found them in five eyes of 13 patients having Boeck's sarcoid.

8. UVEOPAROTID FEVER. Gilbert,[14] in 1940, checked the literature and suggested that in most cases of uveoparotid fever (Heerfordt's disease) the disease was actually systemic and had an etiology in common with Boeck's sarcoid. Chronic parotitis, uveitis, and frequently paresis of the seventh nerve are present. Savin[29] describes the syndrome.

9. MIKULICZ'S SYNDROME. It is now believed that Boeck's sarcoid is one of the causes of this syndrome.

10. MISCELLANEOUS. Snapper[31] mentioned the frequent localization of sarcoid in the tonsils and said that, when no lesion of skin or lymph nodes exists, the diagnosis by biopsy can be made from the tonsil. In 1931, Reis and Rothfeld[32] reported the autopsy of a case in which the optic nerve, chiasm, and base of the brain were involved.

LABORATORY

Usually there is slight leukopenia. Some cases show eosinophilia, Reisner[6] says up to 25 percent, while monocytes increase early in 50 percent. At Hines Hospital six of 32 cases showed elevated eosinophil counts of from four to 13 percent. Usually the albumin-globulin ratio is reversed. Seven of 22 cases at Hines showed a reversal of the A/G ratio at some time.

The tuberculin test is almost always negative. Gifford and Krause[5] state that, at the University of Chicago, the testing is begun with 0.1 cc. of 1:100,000 O.T. intracutaneously, and then the concentration is increased. If the test is positive to 1:100, they feel the findings are compatible with a diagnosis of sarcoidosis, while sensitivity to 1:1,000 is considered questionable.

A false-positive Wassermann reaction can occur (absence of history of luetic infection plus failure to respond to antiluetic therapy). The sedimentation rate may be elevated. The serum calcium may be elevated—seen in seven out of seven cases by Curtis.[4] Cogan[17] noted Boeck's sarcoid in two cases of hypercalcemia with superficial corneal deposits. The nonprotein nitrogen and blood-urea-nitrogen were elevated in six out of 10 cases reported by Curtis.[4]

In 1941, Kveim[24] described what he considered a specific skin test for sarcoidosis—the Kveim reaction. When a heated salt suspension of lymph glands from active cases of sarcoid was injected intradermally, a small dark-red hard papule appeared slowly and remained.

Tissue from the response site showed a microscopic picture similar to the tissue from an active case. When old tuberculin and Frei antigen were injected, the response was not related. This sarcoid material gave a negative response in people with syphilis and lupus vulgaris.

Subsequent studies have generally confirmed Kveim's findings, but there is evidence that other substances, such as killed tubercle bacilli, when injected intracutaneously, can produce a similar reaction.

Nelson[24] studied the Kveim reaction in Negroes with sarcoidosis. Seven out of 11 cases were positive but no healed or inactive case was positive. The patients who gave positive Kveim reactions also gave positive response to a suspension of normal human spleen.

Leider,[8] reviewing skin reactions in sarcoidosis, feels that, although the Kveim reaction is a valuable test, it needs to be standardized. He feels it actually is evidence for tuberculin anergy. Lemming reported a similar response with BCG vaccine.

Harrell and Horne[20] showed that patients with leprosy or tuberculosis gave a positive lepromin reaction. They also reported that those with sarcoidosis showed very little, if any, reaction.

Therapy

General therapeutic measures of high caloric, high-vitamin diet, rest, and sunshine have been recommended. Specific therapy, such as potassium arsenite, arsphenamine, X rays, ultraviolet, tuberculin, gold, and chaulmoogra oil, has been tried and the results are questionable.

Since 1947, Curtis and Taylor[25] have used calciferol and dihydrotachysterol. They believed that vitamin D_2 acted on the phosphorus in the phospholipids, removing the phosphorus from soft tissues and bone. By increasing the phosphorus excretion, the phospholipids might be disturbed; thus a factor in the production of the epithelioid cells might be hindered. They gave 50,000 to 300,000 units per day.

Patients do not tolerate calciferol well and the severity of the reaction is proportional to the severity of the disease. Anorexia, nausea, vomiting, malaise, weakness, and vertigo may occur. Curtis says this is due to the elevated nonprotein nitrogen and calcium. The blood calcium and nonprotein nitrogen should be checked prior to therapy and, if elevated, smaller doses should be used.

Improvement is most rapid in the first few weeks. One of Curtis's five cases had an iris nodule which disappeared after treatment. He thought that the patients who developed toxic reactions had quicker and greater degrees of improvement. In discussing the paper, W. F. Lever warned of the danger in using large doses of vitamin D_2 which may induce hypercalcemia and renal insufficiency.

Prognosis

The life expectancy in patient's with sarcoidosis is almost the same as in other persons. Only in extreme cases is life cut short. Seventy-five percent of the cases are not serious. Of 28 cases studied,[6] nine had outstanding regression, five were stationary, five had alternate progression and regression, and nine progressed; of these nine, seven patients died, almost all of tuberculosis. Some patients show extensive lung involvement and resultant damage to the right side of the heart.

Tice and Sweany[27] reported a fatal case in which only pulmonary and hilar lymph node involvement was present. No caseation or acid-fast organisms were seen and there was no skin involvement.

Osterberg[18] called attention to a case of Watz in which, because of large hilar shadows and dyspnea, the patient was treated by surgery—605 gm. of glandular tissue attached to the aorta, great veins, and trachea were removed. The patient lived for 16 years, with a recurrence of mediastinal nodules and finally death from cardiac insufficiency.

Some of the eyes showing sarcoidosis terminate in phthisis bulbi and some in secondary glaucoma.

Case report

History. W. A., a 27-year-old white man, was admitted to Hines Veterans Hospital, Hines, Illinois, February 18, 1948, complaining of shortness of breath associated with productive cough of two months' duration. The sputum was white mucoid material with no blood streaking. There had been left lower chest pain for one and one-half months prior to admission which was aggravated by coughing and breathing. There was no weight loss. In December, 1947, he began to note redness, soreness, and decreased vision in his right eye.

In 1943, he had catarrhal jaundice and was hospitalized for two months. He had pneumonia in 1943. In August, 1947, he developed right upper quadrant pain with tenderness to pressure. The diagnosis of gastritis was made.

Physical examination. There was increased tactile fremitus and vocal resonance of the left chest posteriorly below the seventh rib. Moist rales were noted in both sides posteriorly in the bases. There were enlarged submandibular nodes on the left side.

Laboratory findings. The sedimentation rate, urinalysis, and complete blood count were normal. The Kahn and complement fixation tests were negative as were smear and cultures on nine sputum samples and five gastric washings examined for acid-fast organisms. The total protein was 5.8 with an albumin/globulin ratio of 1.0. Cultures were negative for yeast and fungi.

Consultations. On February 26, 1948, he was seen in the eye clinic. Vision was: R.E., 20/20; L.E., 20/40—2. The left eye had ciliary tenderness and deep ciliary injection. The anterior chamber had

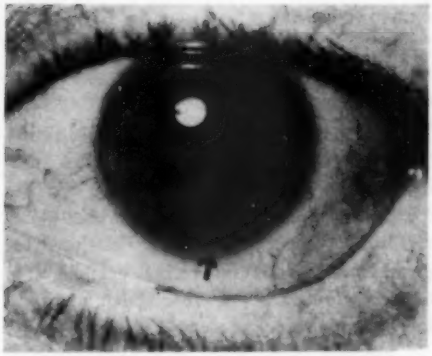

Fig. 1 (Friedman). A cystlike mass was noted in the right eye at the 5:30-o'clock position.

a three-plus flare, the iris was immobile, and there were many posterior synechias.

X-ray studies on February 25, 1948, showed blotchy soft areas of increased density in the lower three fifths of both lung fields. The apexes were clear. The findings were consistent with those in Boeck's sarcoid. X-ray films of both hands and feet showed no bony abnormality or cystic change.

Hospital course. Volmer patch test and skin tests with first and second strength purified protein derivative were negative. He was placed on atropine eye drops. On March 12, 1948, a biopsy of the right submaxillary node was reported as Boeck's sarcoid.

On April 1, 1948, examination of the right eye showed vision of 20/30—2 with pinhole. Several posterior synechias extended from the pigment layer of the iris. There was no flare. The fundus was normal except for a thin veil over the inferior portion of the disc suggestive of a remnant of Bergmeister's papilla.

In the left eye, vision was 20/30—2. There were numerous mutton-fat keratic precipitates in the lower half of the cornea. Many posterior synechias, reddish in color, extended like spokes of a wheel, from the pigment layer of the iris to the capsule. The iris showed several areas of atrophy. No flare remained. The fundus was normal.

During his hospital stay, he ran a low-grade fever for 12 days. The chest pain and cough disappeared and he was discharged April 5, 1948, with a diagnosis of generalized sarcoidosis, Boeck's, with bilateral chronic iridocyclitis.

On December 17, 1948, the patient was seen by medical department. There was an absence of symptoms except for tendency to tire easily. Chest X-ray films showed slight clearing.

Eye condition. In February, 1949, he was seen in the eye clinic where a fairly smooth gray-brown cystlike mass was noted in the right eye at the 5:30-o'clock position in the anterior-chamber angle but attached to the peripheral iris (fig. 1). There was a small vessel running over it. By means of a goniolens, about four or five fleshy similar masses were seen from the 4- to 7-o'clock positions at the base of the iris in the angle. Each nodule had a fine vessel on it.

Visual acuity was: R.E., 20/20—2, with correction; L.E., 20/20—2, with correction.

He was placed on 50,000 units of calciferol* four times daily. Within two days, the dose had to be cut down because of gastritis. Within another couple of days, although getting only a single dose daily, his nausea was so severe, medication had to be discontinued.

On March 21, 1949, about 30 days after beginning the calciferol, examination revealed the same lesions, but each cornea had a haziness due to superficial fine white dustlike opacities scattered irregularly. There was no definite staining and no hypesthesia. Vision was the same and the tension was normal. Chest X-ray films (fig. 2) showed residual infiltration in the lower chest.

On April 5, 1949, the right cornea was littered with fine white, soft, dustlike deposits on surface epithelium. The deposits were mainly concentrated in an arc near the limbus; at the central area and limbus near the 6-o'clock position they were less

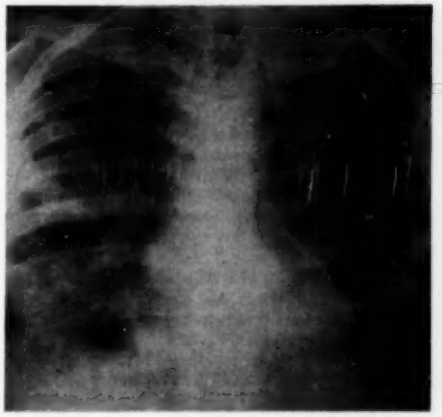

Fig. 2 (Friedman). Chest X-ray film (March, 1949) shows residual infiltration in the lower chest.

concentrated. There was a clear space between the limbus and the arclike deposits. The left cornea contained the opacities deposited in a U-shaped arc, while the central area was clear. Neither pupil would dilate satisfactorily with neosynephrine (fig. 3). The vision was: R.E., 20/20; L.E., 20/25, with correction.

By April 19, 1949, the superficial precipitates had decreased in amount, especially in the left eye where they were almost gone. Several small, white keratic precipitates were present on the endothelium. The iris nodules were still present, although apparently smaller.

* I wish to thank Dr. Fershing of the Medical Department, Hines Hospital, for his coöperation.

Fig. 3 (Friedman). Appearance of eye in April, 1949.

Second admission. The patient was readmitted to the hospital, May 16, 1949, stating that, two days earlier, he had developed sudden severe pain and cloudy vision in the right eye, accompanied by nausea and vomiting. Vision improved during the day of admission but the tension was 60 mm. Hg (Schiøtz). The superficial corneal deposits previously noted were present. The nodules formerly seen had practically disappeared. However, there was a marked tenting of the iris below, as if a mass might be behind it. There were numerous posterior synechias. The left eye was the same as on previous examinations.

On the next day (May 17, 1949), a basal iridectomy of the right eye was performed at the 12-o'clock position. Through an unfortunate misunderstanding, the excised iris tissue was not saved.

The patient made an uneventful recovery from the glaucoma. He was put on intravenous typhoid. Vision returned to 20/25. The iris nodules could no longer be seen even with the goniolens, but the corneal deposits were still present.

The Volmer patch test and brucellergen skin tests were negative. The alkaline phosphatase was 5.0. The spleen was slightly enlarged but the edge was not tender. There was definite adenopathy only in the left axilla.

A complete blood count, Kahn and complement-fixation tests were negative. Urine showed a trace of albumin. The nonprotein nitrogen was 43.4; total protein, 7.5; albumin-globulin ratio, 1.36; cholesterol, 178; sodium chloride, 615. Repeat tests showed the total protein to be 7.9; with albumin, 4.7, and globulin, 3.2. X-ray films of the hands and feet were normal.

Diagnosis. The patient was discharged with the following diagnosis: (1) Boeck's sarcoid, generalized, unchanged; (2) chronic iridocyclitis due to Boeck's sarcoid, active in the right eye, improved; inactive in the left eye, unchanged; (3) acute glaucoma of the right eye, secondary to Boeck's sarcoid, cured.

Summary

The most frequent ocular manifestation of Boeck's sarcoid is a granulomatous uveitis, usually bilateral. Some authors feel the iris nodule is characteristic. Lacrimal-gland swelling,[28] corneal opacities, conjunctival granulomas, chalazions, retinal periphlebitis, and chorioretinitis are other ocular manifestations which may present themselves.

Clinically, there may be dyspnea, cough, and multiple papules involving the face, trunk, and extensor surfaces of the extremities, as well as painless lymphadenopathy, parotid-gland swelling, and an enlarged spleen.

X-ray studies of the chest and hands should be done on every suspected case. A biopsy of an enlarged lymph node and, if none is found, of a tonsil, can confirm the diagnosis. Snapper[31] refers to the use of liver puncture for diagnostic confirmation. A negative tuberculin test (especially) and reversal of the albumin-globulin ratio are characteristic. The Kveim reaction may become very helpful.

Although skin and bone lesions may be present, they are not essential to the diagnosis. The disease presents serious objec-

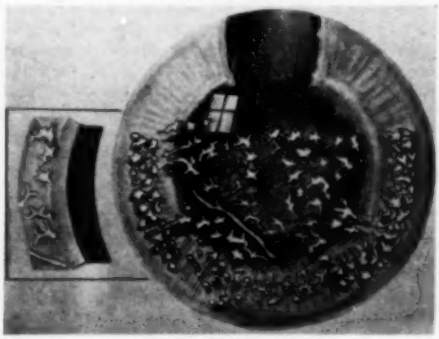

Fig. 4 (Friedman). Following iridectomy, no clinical evidence of the iris nodules remained, but the superficial corneal deposits were still present.

tive findings but, as a rule, the subjective symptoms are mild.

At the present time, representatives of one school of thought believe sarcoidosis to be an atypical form of tuberculosis. They consider the negative tuberculin test to show a form of immunity. Other workers feel that sarcoid is due either to a virus or to a nonspecific reaction of the body tissues to a number of agents. Curtis[4] suggests that the disease is a response to phospholipids stimulated by foreign-body substances or present in microörganisms.

Until recently, specific therapeutic measures have been of debatable value. In 1947, Curtis and Taylor[28] introduced the use of vitamin D_2 (calciferol) in sarcoidosis. The rationale was their belief that the disease is a response to phospholipids. By increasing phosphorus excretion, the phospholipids might be disturbed and a factor in producing epithelioid cells might be damaged.

On the basis of the work by Curtis and others, the patient herein reported was given calciferol. Within a very few days, the calciferol had to be discontinued because of a toxic reaction.

About three weeks later, superficial white dustlike deposits, arranged mainly concentrically near the limbus, were noted in both corneas. After another two weeks, the iris nodules began to disappear and the corneal opacities decreased. About six weeks later (or 12 weeks following the administration of vitamin D_2 in the form of calciferol), he developed an acute glaucoma.

Following iridectomy, no clinical evidence of the iris nodules remained, but the superficial corneal deposits were still present (fig. 4). His present serum calcium level is 10.9 to 11.3; nonprotein nitrogen is 41.5.

One wonders whether the calciferol was responsible for the corneal deposits. Meesmann[17] had described superficial corneal opacities in a patient getting dihydrotachysterol (D_3) for surgical hypoparathyroidism. Since the patient had glaucoma, Meesmann believed the latter was the probable cause of the keratopathy, although the hypercalcemia might be contributory.

In our case, the corneal deposits preceded the glaucoma. Although Meesmann's patient received overdosage over a long period of time, our patient actually received his large doses of vitamin D_2 over a short period. Furthermore, the corneal opacities in our case did not reveal themselves until after the drug was no longer administered.

Another question which this case introduces is whether the calciferol actually contributed to the disappearance of the iris nodules. Again the shortness of the treatment period would seem to deny this. Nevertheless there were no traces of nodules less than three months after use of the drug.

213 Doctor's Building (2).

I wish to express my appreciation to Dr. M. M. Kulvin and Dr. James E. Lebensohn for their generous help.

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NEW SURGICAL TREATMENT FOR POSTOPERATIVE CATARACT*

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Surgery on a postoperative cataract or a membranous cataract is frequently more difficult because the membrane in the pupil is tough. The two main reasons for this difficulty are:

1. The secondary cataract is supported by the vitreous humor, iris, and zonula Zinni. Any one of them is semifluid or composed of soft tissue, thus making the structure unstable and likely to move under the operating knife when the tough membrane of the postoperative cataract is encountered.

2. According to other known procedures, the difficulty experienced by the surgeon is that, when an incision is made on the cornea, fluid seeps from the anterior chamber and makes use of the knife difficult. In addition, the seepage causes the diameter of the pupil to change.

In the technique which I shall presently describe, the difficulties just mentioned are removed; the postoperative cataract is held firmly and collapsing of the anterior chamber is prevented.

ANTERIOR-CHAMBER NEEDLE

The anterior-chamber needle (fig. 1) is used for holding the cataract firmly, as a basting pin is used in sewing. The needle is four cm. in length and one-third mm. in diameter. It has a little head like a pin. The shaft of the needle is of uniform thickness.

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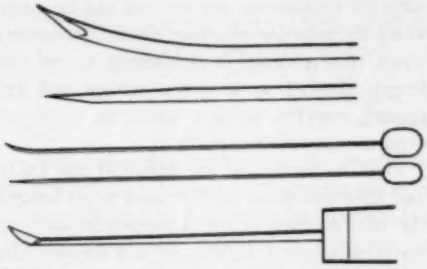

Fig. 1 (Sato). The four upper figures illustrate the anterior-chamber needle. The lowest drawing is of the corneal knife.

The point, however, is curved a little (fig. 1).

Most attention should be paid to the point, which is not conical but flat and curved. At the end, it has an edge which is sharpened like a chisel. If the point were conical like that of an ordinary needle, it would be difficult to perform the operation. The head is slightly flattened so that the operator can feel the position of the needle in the anterior chamber.

Corneal knife

The some knife (fig. 1) which I described for my operation for conical cornea and for astigmatism (Am. J. Ophth., **33**:943, 1950) can be used. The blade of the knife is 2.5 mm. in length and 0.9 mm. in width; the shaft is 0.7 mm. in diameter (fig. 2).

Particular attention must be paid to the construction of the knife. The width of the blade and the diameter of the shaft must be in exact proportion. When the knife is correctly made, no liquid leaks during the operation and the knife moves easily when the lens is being cut.

Method of operation

Before operation, the pupil is dilated as widely as possible with atropine, and cocaine drops are used for an anesthetic. A speculum is placed. The operator and an assistant hold the limbal conjunctiva firmly with fixation forceps. The most suitable positions for the forceps are shown as Q and S in Figure 2.

The anterior-chamber needle is inserted in the cornea at the limbus and directed into the anterior chamber. Since the forceps, needle, and knife must be used in close proximity (fig. 2), it is well to place them one to two mm. apart. Usually, the forceps are placed at the top and the other two instruments below.

The operator holds the head of the needle with his thumb and forefinger and inserts the point through the corneal limbus into the anterior chamber, and then carefully pierces the posterior surface of the postoperative cataract. If the pupil is round and the cataract diffuse, he must prick the cataract with the needle at the nearest part of the lateral side of the border of the iris. The needle is then passed between the vitreous humor and the cataract to the median side of the border of the iris.

Great care must be taken to make the needle travel along the posterior surface of the cataract, lest the vitreous body be injured. If it is difficult to pass the needle through the cataract from the posterior into the anterior chamber, it is advisable to give a slight thrust.

When the point of the needle comes into the anterior chamber, it must pass through to the cornea in the neighborhood of the median side of the limbus by way of the front of the iris. The point of the needle must protrude one or two mm. from the cornea, thus skewering it (fig. 2). It is not necessary to hold the needle once it is fixed in the manner just described.

Usually, I insert the needle horizontally. In so far as possible, the operator should pass the needle through the pupillary area a little to the upper part of center so that the incised ends of the membrane will be more contractable. If the pupil is not round, the needle

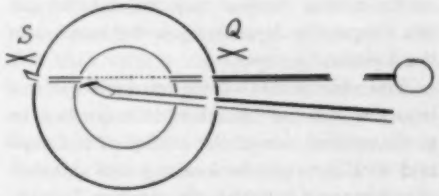

Fig. 2 (Sato). Illustrating the use of the anterior-chamber needle and the corneal knife.

must be passed along the longer diameter.

When the elongation of the pupil is vertical, the needle should be inserted into the cataract as shown in Figure 3. In almost all cases, however, both needle and corneal knife are used in a horizontal position, thus forming a vertical aperture in the membrane.

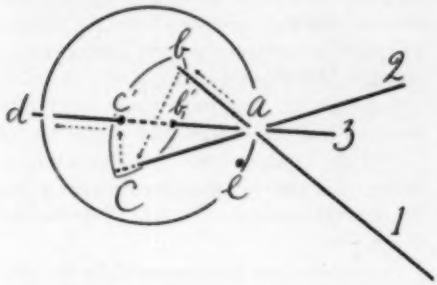

Fig. 3. (Sato). Diagram showing operative technique. (a) Point where the needle is inserted through the cornea. (b) Point where the needle is inserted into the cataract. (c) Point where the needle comes from the posterior surface of the cataract into the anterior chamber. (b'-c') When the needle is fixed at a and d on the cornea, the points of b and c on the cataract come to b' and c'. (e) Point where the knife will be inserted through the cornea. After cutting b' to c' horizontally, the operator will find a vertical aperture in the position of b to c.

The corneal knife is usually inserted in the cornea in the region of the limbus, 0.5 to 1.0 mm. toward the pupil, into the anterior chamber (fig. 2). Either one of the fixation forceps (S or Q in figure 2) may be used but, when the medial one is held, the lateral one must be released.

Sometimes during the operation, the view of the anterior chamber is obscured by minute wrinkles in the cornea. These wrinkles are usually caused by unnecessary pressure on the cornea. A clear view through the cornea frequently depends upon the location of the fixation forceps.

After the corneal knife has been inserted into the anterior chamber, it is pushed up to the medial side of the border of the pupil and then brought back along the anterior-chamber needle, cutting the cataract. In ordinary circumstances, the incision can be made along the anterior-chamber needle. However, when this is done, it is difficult to cut the length desired at a single stroke and repeated, careful strokes must be made to separate the affected parts.

It is better to use the point of the knife and slice sideways, as if it were to go behind the needle, than to use it perpendicularly to the membrane of the lens. In this manner, the point of the knife will go behind the anterior-chamber needle, and the operator will have no difficulty in cutting the cataract. There will also be minimal danger of injuring the vitreous humor.

Since, in spite of the needle and the knife, the liquid in the chamber will not leak out, the operator can observe the affected parts, perform the operation with composure, and be ready to take whatever step the occasion demands. However hard and thick the postoperative cataract may be, since it is firmly fixed on the needle, he will be able to cut it easily.

The operation is relatively simple. There is no danger of injuring the iris with the knife and, even when the pupil is small and the iris somewhat inflamed, there are no ill aftereffects. My technique may be used in cases in which other methods would prove difficult, especially in cases in children who will not remain quiet during operation.

After the cataract is cut, the corneal knife is withdrawn for the first time, and the needle is removed. Care must be taken to bring neither the knife nor the needle into contact with the iris. As an added precaution, it is my custom to tap both the needle and knife incisions with a spatula. This, however, is scarcely necessary, since the cuts are so slight that the fluid in the chamber barely seeps out, and there is no danger of adhesion of the iris.

The operation herein described is safe and technically simple for both postoperative and membranous cataracts. It seems superior to other known methods.

Jutendo Medical College.

CHANGES IN THE INTRAOCULAR PRESSURE IN NORMAL AND GLAUCOMATOUS EYES FOLLOWING FURMETHIDE*

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This study was undertaken to determine the immediate effect of a 10-percent solution of furmethide (furfuryl trimethyl ammonium iodide) upon the intraocular pressure in normal eyes and eyes having primary wide and narrow chamber angle glaucoma. The question which initially prompted this investigation was this—Is there anything characteristically different in the fall in intraocular pressure following furmethide in normal eyes and eyes with primary wide and narrow chamber angle glaucoma, each of which has the same initial pressure of 30 mm. Hg or less?

Corollaries to this initial question were: (1) How does the response to furmethide differ in the normal and in the glaucomatous eye, (2) is there a difference in the response between the narrow-angle and the wide-angle types of glaucoma, (3) in eyes having narrow-angle glaucoma with an elevated tension is the presence of congestive signs and symptoms associated with an altered response to furmethide, (4) what is the relationship of the response to furmethide to the visual field loss, (a) at the time of the test and (b) subsequent to the test?

In 1918, Carr[1] became interested in "borderline glaucoma" cases, as well as cases of unilateral "simple glaucoma" and "acute inflammatory glaucoma." In order to determine whether or not normal tension is reducible by miotics he studied the early effect of eserine salicylate (one- or two-percent solution) upon both normal eyes of 100 individuals between the ages of 12 and 67 years. In the 200 eyes the average tension just prior to the intillation of eserine was 15.83 mm. Hg (Schiøtz), and following the production of miosis was 15.62 mm. Hg. In none of the eyes was there a lowering of tension of more than three mm. Hg. No cases of glaucoma were reported.

The idea of the use of miotics as a therapeutic test in the diagnosis of preglaucoma or early glaucoma is not a new one. In 1937, Girgis[2] reported the pressure-lowering effect of eserine in what he described as a diagnostic test for glaucoma. He studied "about 40 cases" of primary chronic glaucoma with tensions varying within the upper limits of normal (usually between 20 and 27 mm. Hg), as well as 162 normal eyes in patients between the ages of 15 and 25 years.

The dosage of eserine used was not given in the patients having glaucoma. In the normal patients he used a standard test with eserine salicylate (0.5-percent solution) and instilled one drop into the conjunctival sac every 10 minutes for six doses.

The maximum drop in pressure at one hour in any of the normal eyes was five mm. Hg. He felt that a reduction of more than five mm. Hg in intraocular pressure at one hour was abnormal, that a reduction of between five and eight mm. Hg was suspicious of glaucoma, and a reduction of over eight mm. Hg, when other signs were present, pointed to a diagnosis of glaucoma.

In 1949, Scheie[3] pointed out that eserine produced a rise in intraocular pressure in the normal eye.

In 1944, Díaz-Domínques[4] noted that the normal eye in patients with unilateral primary glaucoma may respond with hypotension upon the instillation of pilocarpine. He felt that such a reaction might indicate a predisposition to glaucoma, since the tension of a nonglaucomatous eye is usually not reduced initially by pilocarpine. He considered that this hypotensive reaction should be kept in mind in cases of suspected glaucoma.

* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University.

Experimental procedure

In the experiment herein reported a 10-percent solution of furmethide was used.

The ocular pharmacology of furmethide was first reported in 1940 by Myerson and Thau.[5] They found that solutions of 5.0- to 20-percent furmethide, when instilled into the normal human eye, produced effects similar to mecholyl; however, these effects appeared more promptly, were of greater intensity, and of longer duration.

Miosis began within two to four minutes after instillation of the drug and reached a maximum within five to seven minutes. The intraocular pressure began to drop in eight to 10 minutes, reaching its lowest point in about one hour and the hypotensive effect persisted for about 24 hours; in some instances the hypotensive effect lasted only about 12 hours and in others it persisted more than 24 hours. A 10-percent solution was found to be easily tolerated, but a 20-percent solution induced transient headache and nausea.

The use of furmethide in the treatment of glaucoma in patients admitted to the Wilmer Institute was studied in 1943 and 1946. In 1943, Uhler[6] found that a 10-percent solution of furmethide was slightly more effective than a two-percent solution of pilocarpine in reducing the intraocular pressure in cases of chronic glaucoma.

In 1946, E. Uhler Owens and Woods[7] pointed out the value of furmethide in the treatment of primary glaucoma, especially in the more severe cases. They found that a 10-percent solution is more effective than the synergistic use of a 20-percent solution of mecholyl and a five-percent solution of prostigmin in late cases of primary glaucoma, and in those cases of primary glaucoma in which the previous use of other miotics had failed.

They studied the clinical value of furmethide in both primary and secondary glaucoma in reducing the tension from more than 40 mm. Hg prior to therapy to 35 mm. Hg or less following therapy. The period of observation is not stated but presumably was about 24 hours. However, no controlled study can be found in the literature concerning the comparative fall in tension within the first hour following instillation of furmethide in normal eyes and eyes having primary glaucoma.

Technique

A standard dosage of furmethide was used throughout this experiment (except, as will be pointed out later, in one case of acute congestive glaucoma); that is, one drop of a 10-percent solution was instilled into the conjunctival sac every 15 minutes for four doses. Tensions were taken with the patient in a recumbent position after instillation of two drops of 0.5-percent pontocaine solution.

With but a few exceptions in eyes with acute congestive glaucoma, the same standardized Schiøtz tonometer was used in all cases; tensions were taken just prior to as well as at 30 and 60 minutes following the first instillation of furmethide. In general, each of the three weights was used once in each tonometric observation. When possible, the two readings in which the tonometer pointer gave a figure within the range of three to seven were then converted into millimeters by interpolation from the Schiøtz nomogram and the two figures were then averaged.

In normal patients in whom the tension had never been taken, the initial reading was repeated with the 5.5-gm. weight until good coöperation was obtained and until the reading could be duplicated. Tension curves on 10 of the 11 cases of acute congestive glaucoma were taken by other members of the Wilmer Institute house staff in a similar manner.

Selection of patients

In the first part of this experiment, several types of patients were studied. The first type were normal patients with no evidence of ocular pathology with the exception of an occasional case with incipient lenticular opacities. These patients, with one exception, were above 40 years of age and had been re-

ferred to the refraction clinic with a diagnosis of refractive error and presbyopia. None of these patients had any symptoms or signs of glaucoma. The average age of this group of patients corresponded fairly closely with that of the glaucoma patients.

A second group consisted of three essentially normal eyes without previous evidence of glaucoma in patients whose opposite eye had primary wide-angle glaucoma; and two essentially normal eyes without previous evidence of glaucoma in patients whose opposite eye had primary narrow-angle glaucoma. None of the five eyes had shown any evidence of glaucoma, although they had been kept on prophylactic therapy with miotics. Miotics were discontinued 24 hours prior to to the test.

The third group of eyes tested were those of patients with primary wide-angle glaucoma in which the intraocular pressure was controlled by the use of miotics, usually pilocarpine (two-percent solution), one to three times daily, with or without eserine (0.25-percent) ointment at night.

The fourth group of eyes tested were those in patients with primary, chronic or acute, narrow-angle glaucoma in which the tension was controlled by miotics similarly to the patients with wide-angle glaucoma. In all patients who had glaucoma and were receiving treatment, miotics were discontinued for at least 24 hours prior to the test. None of the eyes tested had been subjected to any type of surgical procedure.

Tests were made on new patients with untreated wide- and narrow-angle glaucoma. In order to supplement the data on acute congestive glaucoma, the histories were reviewed of patients in an acute congestive attack who were admitted to the public ward of the Wilmer Institute during the past three years. Those who received the same dosage of furmethide and whose tension studies were adequate for analysis were included in this study.

TABLE 1

OCULAR RIGIDITY

	Type of Eye	No. of Tests	No. of Eyes	No. of Patients	Rigidity		
					Initial	30 Min.	60 Min.
No Furmethide	Normal	6	6	6	7.6	6.4	7.0
Furmethide	Normal	23	23	16	7.5	6.9	6.9
	Wide Angle	8	8	5	6.9	7.3	6.3
	Narrow Angle	2	2	1	5.4	6.2	6.5
Total		33	33	22	7.2	6.9	6.7

RESULTS

The results of the various steps in the investigation with furmethide will be summarized graphically. Similarities, as well as characteristic differences, between the various types of eyes studied will be pointed out.

Calculations were made of the ocular rigidity and the intraocular pressure according to the method of Friedenwald (table 1).

Tensions were taken in 33 eyes which received furmethide, consisting of 23 normal eyes, as well as eight eyes with wide-angle and two eyes with narrow-angle glaucoma. Tensions were also taken in six normal eyes which did not receive furmethide. These figures showed that there was essentially no change in the ocular rigidity in any type of eye tested and that the changes in tension (Schiøtz) were due to corresponding changes in the intraocular pressure of Friedenwald.

However, it was found by using scatter graphs for each method that, for the purposes of this experiment, greater accuracy could be obtained in each observed change in pressure by following the technique outlined previously; that is, using the usual Schiøtz

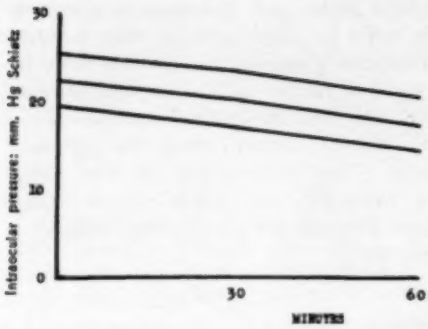


Fig. 1-A (Goodwin). Effects of furmethide on the intraocular pressure in 36 normal eyes. (10-percent furmethide, every 15 minutes, four times.)

nomogram. Therefore, this method has been used throughout.

A group of six normal eyes representing six patients was examined to determine the massage effect of the tonometer compression alone without furmethide. The same technique of tonometry was used as already outlined for the eyes tested with furmethide. The tonometer compression was found to be negligible in each case with a mean drop of 1.1 mm. Hg at one hour.

The effects of furmethide on the intraocular pressure were studied in normal eyes representing 21 patients. Eyes having deep and shallow anterior chambers gave essentially the same response to furmethide. The average drop in tension at one hour for all normal eyes was 5.1 mm. Hg. Figure 1-A shows the average curve of the drop in tension in the 36 normal eyes in the center. The standard deviation is given above and below to indicate the spread of the individual observations.

Three essentially normal eyes having a wide angle were studied in patients having primary wide-angle glaucoma in the opposite eye. Figure 1-B shows the individual tension curves in the three tests. The average drop after one hour was 10.1 mm. Hg.

Two essentially normal eyes having a narrow angle were studied in patients having narrow-angle glaucoma in the opposite eye. Figure 1-C shows the tension curves in the two tests. The average drop at one hour was 7.0 mm. Hg.

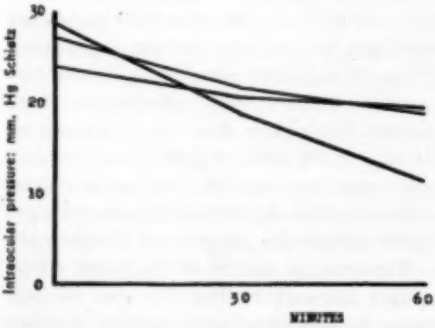


Fig. 1-B (Goodwin). Normal eyes with a wide angle in patients having primary wide-angle glaucoma in opposite eye. (10-percent furmethide, every 15 minutes, four times.)

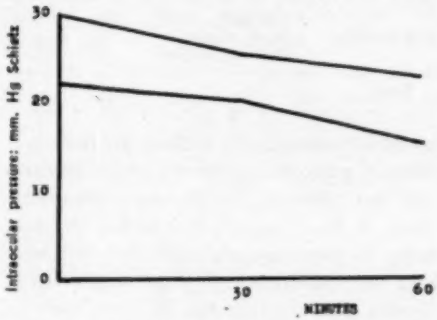


Fig. 1-C (Goodwin). Normal eyes with a narrow angle in patients having narrow-angle glaucoma in opposite eye. (10-percent furmethide, every 15 minutes, four times.)

Tests were made on 15 eyes in nine patients with the diagnosis of wide-angle glaucoma (fig. 2). Of these, six eyes had received no previous treatment. These eyes had an average initial pressure of 41.0 mm. Hg and showed an average drop at one hour of 15.1 mm. Hg.

Eleven glaucomatous eyes, in which the tension had been controlled with miotics and in which miotics were discontinued at least 24 hours prior to the tests, were studied.

(Two of these 11 eyes had been previously studied in the group of untreated eyes.) The average initial pressure was 36.4 mm. Hg and the average fall in pressure at one hour was 13.4 mm. Hg.

The cases which had received treatment, as well as the untreated cases, were arbitrarily divided into two groups—"early" and "late," depending upon the visual field changes. The cases in which there was less than 30 degrees' loss of peripheral field in any meridian and in which the blindspot measured not more than 10 degrees in any direction were arbitrarily considered "early" cases. All others were called "late" cases.

The results showed that, in 10 eyes with "early" wide-angle glaucoma, the average initial pressure was 36.8 mm. Hg, and the average drop at one hour 16.7 mm. Hg. In five eyes with "late" wide-angle glaucoma, the average initial pressure was 40.4 mm. Hg and the average drop at one hour 10.1 mm. Hg. For the group as a whole, the average initial pressure was 38.0 mm. Hg, and the average drop at one hour was 14.5 mm. Hg. The relative importance of the height of the initial pressure and the difference in response to furmethide between "early" and "late" cases will be discussed later.

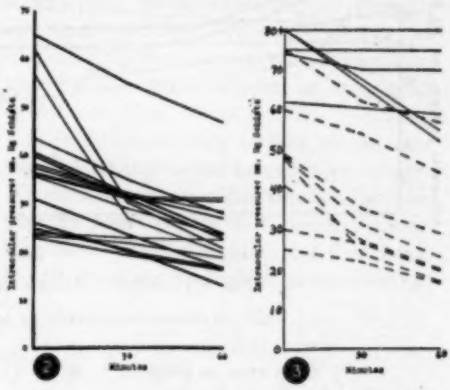
In three eyes with wide-angle glaucoma, a second test was done to see if the original observations could be reproduced. The initial pressures were fairly close in each of the two tests on each eye. The curves of the average values of the first and second test corresponded closely in the three eyes tested.

In Figure 3 the tension curves are shown for all eyes studied having narrow-angle glaucoma; the solid lines represent eyes in an acute congestive attack, while the dotted lines represent eyes having a narrow angle without congestive signs or symptoms.

Five eyes representing four patients with a diagnosis of narrow-angle glaucoma, in an acute congestive attack, were examined. The initial pressure in three eyes was "off the scale" using the 10-gm. weight with the Schiøtz tonometer, and thus the pressure was either 80 mm. Hg or above.

A sixth eye, represented by the curve having the highest tension values and showing no response to furmethide, received more than the standard initial dosage schedule but is included in Figure 3 only because of its negative response. In this eye one drop of furmethide was instilled every 10 minutes for six doses.

The average initial pressure for this group was 70 plus mm. Hg, and the average decline in pressure at one hour was 10 plus mm. Hg. No correlation could be established between the pressure response in these eyes



Figs. 2 and 3 (Goodwin). (Fig. 2) Effects of furmethide (10 percent, every 15 minutes, four times) in tests made on patients with wide-angle glaucoma. (Fig. 3) Responses to furmethide in narrow-angle glaucoma with and without acute congestive signs and symptoms. Solid lines represent eyes with, and dotted lines eyes without, an acute congestive attack.

and the duration of signs and symptoms of the congestive attack, the number of previous attacks, the age, sex, or the previous use of miotics. Figure 3 illustrates the poor early response to furmethide in the majority of eyes having an acute congestive narrow-angle glaucoma.

Eight eyes representing six patients with a diagnosis of narrow-angle glaucoma not in an acute congestive attack were examined. These eyes were likewise arbitrarily divided

into an "early" and "late" group on the basis of the visual field changes.

Four eyes with "early" narrow-angle glaucoma, having an average initial pressure of 42 mm. Hg, showed an average drop of 22 mm. Hg in one hour. Four eyes with "late" narrow-angle glaucoma having an average initial pressure of 52.3 mm. Hg showed an average drop of 15.6 mm. Hg.

For all the eyes not in a congestive attack the average initial pressure was 47.2 mm. Hg, and the average drop at one hour was 18.8 mm. Hg.

All of the eyes which were not in an acute congestive attack responded with a rather rapid fall in pressure at one hour. However, only two of the six eyes in an acute congestive attack responded well at one hour. Some of the factors associated with variations in response will be pointed out later.

In Figure 4, are shown 11 cases of acute congestive narrow-angle glaucoma in which intensive furmethide was used and tension curves plotted. The initial doses were given at 10- to 15-minute intervals for four to 16 doses, followed by one drop of furmethide every one to three hours. The dosage schedule in each case is represented by letter symbols, the key to which is noted below.

This graph amplifies Figure 3 and shows that, over a 12-hour period of observation, only two eyes returned to normal levels while the six remaining eyes were resistant to intensive furmethide, responding very poorly and, at the 12-hour interval, had tensions ranging from 48 to 80-plus mm. Hg.

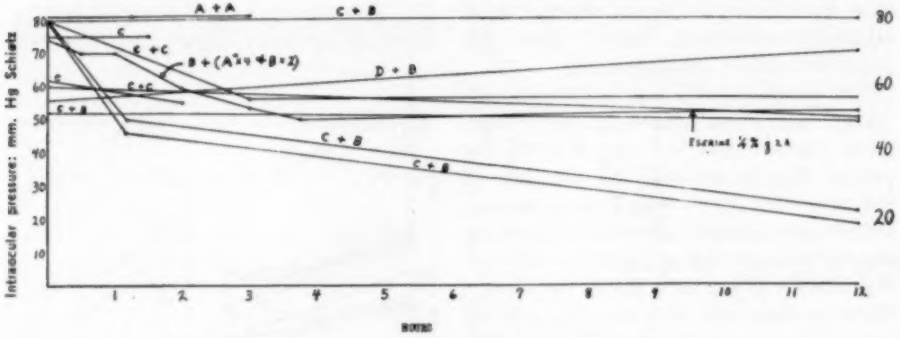


Fig. 4 (Goodwin). Acute congestive narrow-angle glaucoma.

KEY TO DOSAGE OF FURMETHIDE AS INDICATED BY LETTER ON GRAPH:

INITIAL INTENSIVE COURSE
(first letter on graph)

(A) = One drop every 10 minutes for six doses
(B) = One drop every 15 minutes for 16 doses
(C) = One drop every 15 minutes for eight doses
(D) = One drop every 15 minutes for six doses
(E) = One drop every 15 minutes for four doses

MAINTENANCE DOSAGE
(second and third letter on graph)

(A) = One drop every hour
(B) = One drop every two hours
(C) = One drop every three hours

Figure 5 shows an interesting series of tension curves on the same eye with narrow-angle glaucoma. Gonioscopy on this eye on May 15, 1946, showed a narrow angle without synechias. The patient was seen in her first acute congestive attack on August 2, 1948, at which time the tension fell slowly from 54 to 40 mm. Hg after two hours of intensive furmethide drops at 15-minute intervals. Two days later the tension was hypotonic measuring only 10 mm. Hg.

On October 7, 1948, 24 hours after discontinuing her maintenance dose of pilocarpine (1.0 percent, four times daily), this

eye gave a positive dark-room test. Subsequent to this, furmethide was instilled in the eye every 15 minutes for four doses and the tension dropped very quickly in one hour to 24 mm. Hg. (See curve 1 in Figure 5.)

The patient was kept on a maintenance dose of pilocarpine (1.0 percent, four times daily) but failed to return regularly to the glaucoma clinic until she reappeared on March 16, 1950, in a severe acute congestive attack which she had been unable to control at home with frequent use of pilocarpine (1.0 percent).

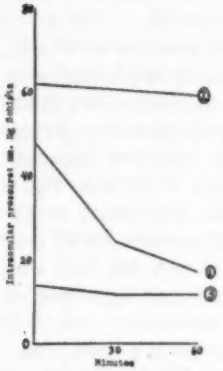


Fig. 5 (Goodwin). Shallow-angle glaucoma. Responses to furmethide of one eye, before (1), during (2), and after (3) an acute congestive episode.

Furmethide was instilled in the eye every 15 minutes and, after one hour, the tension had only been reduced very slightly. (See curve 2, Figure 5.) Then on a maintenance dose of furmethide hourly, the tension fell in five hours from 62 to 42 mm. Hg; on combined therapy with furmethide every hour and eserine (0.25 percent) every hour, the tension fell in the next three hours to 22 mm. Hg. With the tension controlled surgery was deferred for several days in order to allow the eye to become quiet and the inflammation to subside.

Five days after the acute congestive attack was controlled, miotics were discontinued while the intraocular pressure was recorded at frequent intervals. During the next 24 hours, the tension was not recorded at higher than 14 mm. Hg and most of the time was around 9 or 10 mm. Hg. The response to furmethide was again tested and the tension fell from 14 to 12 mm. Hg at the end of one hour (curve 3). Following this, an uneventful iridencleisis was performed.

Thus it is interesting to note that the early response to furmethide is much slower in the acute congestive attack than in the same eye with an elevated tension but not in the congestive phase.

Subsequent to the control of the attack with furmethide and later eserine, during the recovery phase, the tension fell to a hypotonic level being recorded at 9.0 mm. Hg. This stage of mild hypotony during the recovery phase has been noted not infrequently in other patients following control of markedly elevated tensions with furmethide; tensions have been recorded as low as 6.0 or 7.0 mm. Hg.

It is also interesting to note in this case that the tension failed to go above 14 mm. Hg when miotics were discontinued for more than 24 hours during this recovery phase. The most likely explanation for this is that the effects of the furmethide and eserine had

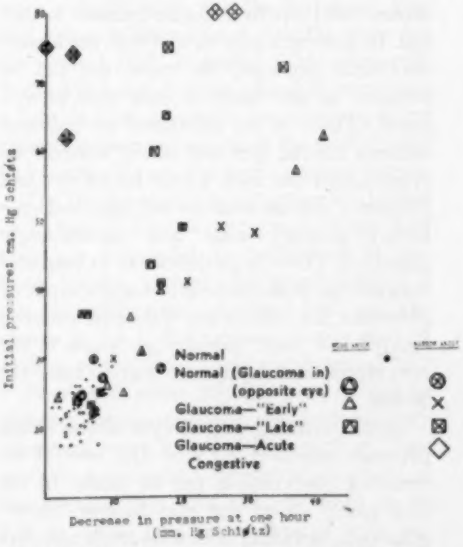


Fig. 6 (Goodwin). Responses to furmethide in one hour in normal and glaucomatous eyes.

not worn off completely. However, in the past when the patient withheld the shorter-acting pilocarpine for more than 24 hours, there not infrequently resulted an elevation sufficient to give her mild congestive symptoms.

It became obvious early in this study that the height of the initial pressure was one of the important factors determining the rate of fall in the intraocular pressure with furmethide, and thus the total drop in pressure at one hour. Therefore, the decrease in pressure after one hour was plotted against the initial pressure on a scatter graph.

Figure 6 is a scatter graph summary of all the eyes tested showing the results of the response to a standard dose of a 10-percent solution of furmethide (one drop every 15 minutes for four doses). The type of eye represented by each of the symbols is shown in the key. A study of the graph can be conveniently divided into two parts—first, the eyes having an initial tension of 30 mm. Hg or less; second, eyes whose initial pressure is more than 30 mm. Hg.

In the first group seven types of eyes are shown. All react in a similar manner to this test. In general it may be said that, the higher the initial pressure, the more the fall in pressure at one hour in each type of eye tested. There is no difference in response between normal eyes and other "normal" or preglaucomatous eyes whose fellow eye had glaucoma, nor between normal eyes and eyes having primary wide- and narrow-angle glaucoma. There is no difference in response between the wide- and narrow-angle types of glaucoma, nor is there any difference between "early" and "late" primary glaucoma in the eyes whose initial pressure was 30 mm. Hg or less.

In the second group of eyes whose initial pressure was over 30 mm. Hg, several interesting observations can be made. In the first place, all of the eyes having "early" glaucoma, including both wide-angle and eyes with a narrow-angle without congestion, fall into a distinct linear pattern which surrounds a mean line extended through the cluster of the 36 normal eyes.

In these eyes, if the mean line were extended, it would bisect the initial pressure (ordinate) at approximately 17 mm. Hg. If 17 is subtracted from the initial pressure, a direct proportion is then found to exist between this value and the decrease in pressure produced by furmethide.

Thus with an initial pressure of 17 mm. Hg, very little if any drop in pressure with furmethide would be expected. As the initial pressure increases, proportionately greater reductions in pressure would be expected. With an initial pressure of 25 mm. Hg, a drop of about 8.0 mm. Hg would be expected; with an initial pressure of 40 mm. Hg, a drop of about 23 mm. Hg; and with an initial pressure of 60 mm. Hg, a drop of about 40 mm. Hg at one hour.

The decrease in tension is a linear function of (or proportional to) the initial pressure minus 17. Therefore, this scatter graph demonstrates that in normal eyes, and eyes with "early" glaucoma (except for the "early" acute congestive eyes), the higher the initial pressure, the greater the drop in pressure after one hour of furmethide.

A second observation can be made pertaining to "late" primary wide-angle glaucoma and "late" narrow-angle glaucoma without congestion. These eyes (represented by the symbol enclosed in a square, Figure 6) responded in all cases by a decrease in pressure which was less than the decrease in eyes with "early" glaucoma both of which had the same initial pressure. In general, it was noted that the greater the loss in visual field, the poorer the response to furmethide at one hour.

Five eyes in the acute congestive phase of narrow-angle glaucoma are shown. The tensions on four of these eyes were taken by other observers, but the dosage of furmethide was identical to that used in the other eyes. All of these eyes responded with a decrease in pressure at one hour which was much less than the eyes with "early" wide-angle glaucoma, and "early" narrow-angle glaucoma

without congestion. More cases of acute congestive glaucoma need to be studied before any conclusions can be drawn within that group of cases.

The question arose as to whether the decline in pressure at one hour was a fixed percent of the initial pressure. The data for all eyes studied were plotted on a scatter graph and it showed essentially the same facts that were noted in Figure 6.

It showed that the percent of decrease in pressure at one hour is not fixed for the normal eyes or for eyes having "early" glaucoma, but that with these eyes, the higher the initial pressure the larger the percentage change in pressure at one hour. The eyes with "late" wide- and narrow-angle glaucoma and the eyes with acute congestive narrow-angle glaucoma showed a progressively lower percentage change in pressure.

In a similar manner, scatter graphs were prepared for the 30-minute tension observations to show the rate of fall in intraocular pressure in relation to the height of the initial pressure. These observations were very similar to those just described for the one-hour figures.

The main difference between the 30-minute and the one-hour observations was that the spread between the "early" and "late" cases becomes more apparent at one hour. For the 30-minute observations, the difference in response between "early and "late" cases whose initial pressure is in the 30 to 50 mm. Hg range is very slight. It is possible that a comparison at two hours might give an even better spread between the "early" and "late" cases whose initial pressure is in the 30 to 50 mm. Hg range.

A scatter graph for the percent change in pressure at 30 minutes was likewise similar to that at one hour but was less effective in showing a difference in response to furmethide between the "early" and "late" cases.

As a second phase in this investigation, an attempt was made to determine if any correlation existed between the response to furmethide and the subsequent loss of control in patients with primary glaucoma who were being treated with miotics. The material in this portion of the study constitutes merely a preliminary report.

A one-year follow-up study was made on 14 of the eyes in the original investigation. The loss of visual field was selected as the single most important criterion of control

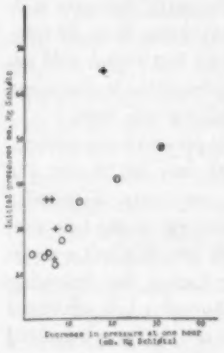


Fig. 7 (Goodwin). Responses to furmethide and visual field changes in eyes followed for one year.
+ = Loss of visual field in less than one year.
o = No loss of visual field after one year.

in glaucoma and at the same time a simple and accurate method of evaluation.

In practically all cases the test objects used were a 6/330 white for the peripheral field and either 3/330 white or 9/1,000 white for the central field. Repeated fields were performed over a follow-up period of more than a year in each case with the emphasis being placed more on the results of the central field, and preferably on the meter tangent screen.

The results of this investigation are shown in Figure 7. This scatter graph shows how each eye responded to furmethide at one hour. Of the 14 eyes, five eyes exhibited a loss, or further loss of visual field, and are shown as "+." The remaining eyes showed no loss of visual field and are shown as "0."

Four eyes, which initially were normal in patients whose opposite eye had primary glaucoma, were followed for one year. Two of these subsequently developed glaucoma in the ensuing year and one eye went on to loss of visual field under therapy with miotics. These four previously "normal" eyes are, therefore, included in this graph among

the eyes whose initial tension was under 30 mm. Hg.

Of the eight eyes whose initial intraocular pressure for the furmethide test was 30 mm. Hg or less, two eyes lost visual field. No correlation is noted between the response to furmethide and the subsequent loss of visual field when the initial pressure was 30 mm. Hg or less with the furmethide test.

Of the six eyes whose initial pressure with the furmethide test was more than 30 mm. Hg, the three eyes which lost visual field responded very poorly to furmethide compared to those eyes which did not lose field.

The eye whose initial pressure was 65 mm. Hg and responded with only an 18 mm. Hg drop in pressure at one hour, responded poorly to miotics subsequent to the test with a "base pressure" of 40 mm. Hg and a range of up to 52 mm. Hg during the following month. This patient showed a loss of visual field at the end of a month and was admitted for surgery.

Of the five eyes which lost visual field, four were "late" when initially tested with furmethide; while of the nine eyes which did not lose visual field, only one was "late" when tested with furmethide. Although no conclusions can be drawn from such a small series, it appears that, in eyes whose initial tension is above 30 mm. Hg and which respond poorly to furmethide, there is an increased probability of loss of visual field within as short a time as one month.

Untoward reactions

No serious systemic reactions were noted. Occasionally patients complained of excessive perspiration and slight nausea. Locally, a mild transient hyperemia of the conjunctiva vessels was frequently noted. The anterior chamber appeared to become slightly shallow in many cases.

The patients uniformly noted moderate blurring of vision within three to 10 minutes after beginning the test, and approximately one half of the patients noted transient headache sometimes moderately severe presumably associated with ciliary spasm, but quickly relieved by aspirin.

Comment

The dosage of furmethide used in this test is one frequently employed in the early treatment of new glaucoma patients. In the patients admitted to the Wilmer Institute with uncontrolled glaucoma, treatment is* instituted using one drop of a 10-percent solution of furmethide every 15 minutes for two hours and then one drop every two to three hours thereafter. When necessary, eserine (0.25-percent solution) is occasionally combined with the intensive furmethide and may be given at two- or three-hour intervals.

With regard to the possible use of miotics as a therapeutic test for the diagnosis of glaucoma, one criticism may be made of the dosage used in this test; that is, a large cholinergic stimulus was used and a moderately severe test was placed upon the cholinergic mechanism. Within the limits of this experiment, however, the cholinergic mechanism appears to be essentially normal since, under the influence of a uniform cholinergic stimulus, the normal eyes and eyes with glaucoma, each of which had the same initial pressure, reacted with essentially the same change in pressure.

It is possible that, if a smaller cholinergic stimulus is used, one might find a difference in the response to miotics between normal eyes and glaucomatous eyes.

Just how long it takes for an eye to become refractory to miotics is unknown and probably quite variable. In one patient, with "early" wide-angle glaucoma who was known to have had glaucoma for six months, the tension went out of control first on pilocarpine and then eserine and furmethide, four times daily.

He was admitted to the Wilmer Institute and the markedly elevated tension in both eyes responded well to furmethide, consistent with his normal peripheral and central visual fields. However, on furmethide five times

* Through June, 1950.

daily the tension began to climb gradually until it reached a "base pressure" in the 40's in one eye and in the 30's in the second eye. Following this an iridencleisis was performed on both eyes.

The evidence therefore is that a refractory state to miotics can be developed in a matter of a few months in primary wide-angle glaucoma, and that this can develop before any changes in the visual field.

No glaucomatous eyes have been found, as yet, in which a poor response to the furmethide test has been associated with a normal visual field, except for eyes having acute congestive glaucoma.

In acute congestive glaucoma the eyes develop a sudden but usually temporary refractoriness to miotics lasting from a few hours up to several days. However, the refractoriness may become more profound in eyes which have had repeated attacks of congestive glaucoma and which show damage as indicated by the visual field.

Summary

The massage effect of the tonometer compression alone was determined in six normal eyes. The response of the intraocular pressure (Schiøtz) to the instillation of one drop of a 10-percent solution of furmethide every 15 minutes for four doses was observed in 69 eyes—36 normal eyes, three "normal" eyes in patients whose fellow eye had wide-angle glaucoma, and two "normal" eyes in patients whose fellow eye had narrow-angle glaucoma.

Thirteen eyes were examined with the standard test in patients with narrow-angle glaucoma, and of these five were in an acute congestive attack. Fifteen eyes with wide-angle glaucoma were examined. Curves of from 1.5 to 12 hours are given for 11 patients in an acute congestive attack of narrow-angle glaucoma. Tension curves in the same eye with narrow-angle glaucoma are given showing the difference in the response during an acute congestive attack and the response with an elevated tension but without congestion.

A comparison is made between the responses to furmethide at 30 minutes and one hour in normal and glaucomatous eyes.

Preliminary results are presented on the relationship of the responses to furmethide and the subsequent loss of visual field in a one-year follow-up of 14 eyes.

Conclusions

1. The immediate effect of furmethide (one drop of a 10-percent solution every 15 minutes for four times) is to reduce the intraocular pressure in the normal eye, as well as in eyes having primary wide-angle and narrow-angle glaucoma.

2. A 10-percent solution of furmethide in the dosage used has no significant influence upon the ocular rigidity.

3. The amount of change in the intraocular pressure in normal eyes and eyes having "early" primary glaucoma is approximately a linear function of the height of initial pressure—roughly proportional to the initial pressure minus 17: (a) The higher the initial intraocular pressure the greater the actual drop in pressure, and also, the greater the percentage change in pressure at 30 and 60 minutes. (b) Under the conditions of this test, there is no significant difference in the immediate response to furmethide between normal eyes and eyes having primary wide- or narrow-angle glaucoma, each of which has the same initial pressure of 30 mm. Hg or less.

4. A posteriori, the response of the intraocular pressure to furmethide in this dosage cannot be used as therapeutic test in the diagnosis of glaucoma.

5. As the height of the initial pressure increases above 30 mm. Hg, the eyes having "late" wide- and narrow-angle glaucoma with moderate to marked visual field loss do not respond as rapidly to the furmethide test as eyes having "early" primary glaucoma. This correlation between the loss of visual field and a decreased response to the furmethide test is more significant at one hour than at 30 minutes.

6. Of the eyes having narrow-angle glaucoma, those in an acute congestive attack appear to respond very slowly to furmethide, compared to the eyes with elevated tensions but without congestive signs and symptoms.

7. Preliminary results are presented on the relationship of the response to furmethide and the subsequent loss of visual field. No definite conclusions can be drawn as yet upon this phase of the study.

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HYPERPHORIA INDUCED BY TRIAL LENSES*

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When measuring the vertical muscle balance during routine examination, one is often confronted by several problems. For example, one may find a variation in the readings done on different days with perhaps no hyperphoria demonstrable on certain occasions. A definite vertical muscle imbalance may be discovered in a person with no symptoms and, if a vertical prism is then prescribed, it is not unusual to have to deal with a patient who is unable to wear his glasses.

In order to avoid such undesirable instances, some men take readings while the patient wears no correction, and it has been my practice to apply a Maddox rod over the patient's old glasses to determine vertical phoria when present. This resulted in an unusual discovery, namely that several patients who exhibited a definite hyperphoria of perhaps one or two prism diopters had none at all when the test was repeated with their old glasses which contained no prisms.

A recent case illustrates this paradox.

Mrs. F. A., aged 28 years, had two manifest refractions done on June 5 and 12, 1950. She had no complaints and this was purely a routine examination. Her old lenses were −3.75D. sph. O.U., and it was decided to make them −4.0D. sph., O.U., with which correction full 20/20 vision was obtained binocularly.

During the first examination one prism diopter of right hyperphoria was found, and during the second, two prism diopters, without which she had diplopia. When the prism was inserted, she experienced relief and said that now she could focus the eyes together. When the hyperphoria, the same for both far and near, was rechecked with her old glasses by placing the Maddox rod directly over one lens, there was orthophoria, even though the old glasses contained no prisms.

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* From the Department of Ophthalmology, College of Medical Evangelists. Read before the California Medical Association, Eye, Ear, Nose and Throat Section, May, 1951.

The solution to this problem was found the next day when I placed the trial frames with the −4.0D. sph. lenses in the vertometer which showed that this lens combination contained one diopter of vertical prism. When each of the −4.0D. sph. lenses were examined separately, it was found that one of them was decentered sufficiently to cause up to 1.5 and the other up to 0.25 diopters of prism effect depending on how the lens was rotated.

This finding was not only an answer to the patient's hyperphoria, but also to its variations because the degree of phoria depended entirely on how the lens was placed in the trial frame. It was, therefore, necessary to alter the patient's original prescription which read: O.D., −4.0D. sph. (0.5 p.d. base-down); O.S., −4.0D. sph. (0.5 p.d. base-up), and cancel the prism which would only have caused trouble for both the patient and the doctor.

Subsequently, it was decided to examine the trial cases of several ophthalmologists in order to estimate the importance of induced hyperphoria as caused by decentered test lenses. A total of 10 trial cases containing 1,264 lenses were examined under a late model Bausch and Lomb vertometer. Four of the trial cases were of the ordinary nonprecision type, four were precision trial cases, and two were cataract trial cases, one of which was of the precision type.

The lenses examined were all spheres, except for the cataract trial lenses which consisted of both spheres and sphero-cylinders.

Errors of 0.25 prism diopter, which were numerous, had to be disregarded in order to simplify the results. Among the cataract test lenses only errors of one prism diopter or higher were counted.

The examining procedure consisted of placing the lens on the vertometer and slowly rotating it without tilting and, at the same time, observing the excursion of the target. No appreciable vertical movement should take place even if the lens is not centered in the vertometer. This is a simple procedure with spheres but, with cataract sphero-cylinders, some difficulty will be encountered.

Here one may either focus the target midway between sphere and cylinder and then rotate the lens (this results in a marked blurring of the target lines, but even then it is possible to estimate its vertical excursion fairly well) or one may attempt to visualize mentally the intersection of the single line group when it is in focus; then the triple line group, first in one position and then repeat this procedure after having rotated the lens in various directions. Because of this difficulty, findings of less than one diopter were disregarded.

TABLE 1

SUMMARY OF RESULTS OF SURVEY OF 10 TRIAL-LENS CASES

Number of trial cases examined:	
Nonprecision trial cases	4
Precision trial cases	4
Nonprecision cataract trial sets	1
Precision cataract trial sets	1
Total	10
Number of lenses examined:	
Spheres, nonprecision	568
Spheres, precision	580
Total spheres	1,148
Cataract spheres and sphero-cylinders	54
Precision cataract spheres and sphero-cylinders	62
Total	116
Total number of lenses of all types	1,264
Number of errors found (0.5 p.d. or more)	347 or 27.4%

Table 1 is an analysis of the results of this survey.

Analysis of errors found:

1. In 568 nonprecision spheres there were:

No. Lenses	*Amount Error* (prism diopters)	*Percent*
87	0.5	15.3
39	0.75	6.8
64	1.0	11.2
32	1.5	5.2
15	2.0	2.6
5	2.5	0.9
1	3.0	0.2
Total: 244 had an error of 0.5 p.d. or more		42.9

2. In the 580 precision spheres there were:

No. Lenses	*Amount Error* (prism diopters)	*Percent*
33	0.5	5.6
12	0.75	2.0
19	1.0	3.2
5	1.5	0.8
3	2.0	0.5
1	2.5	0.2
2	3.0	0.3
Total:	75 had an error of 0.5 p.d. or more	12.9

3. In the 116 cataract trial lenses (spheres and sphero-cylinders) the following errors were found:

a. Among 54 nonprecision lenses there were 25 containing 1.0 p.d. or more, or 46.2%
b. Among 62 precision lenses there were 4 containing 1.0 p.d. or more, or 0.5%

Discussion

Although 27.4 percent of all lenses examined contained a prism of 0.5 diopter or more, the chances of obtaining a false phoria reading were very much different depending on whether a precision trial case was used or not. Almost one half (42.9 percent) of the ordinary trial lenses contained an error of 0.5 to 3.0 diopters; whereas, only 12.9 percent of the precision lenses contained prisms.

It is true that the greatest number of errors were found in the higher-power lenses, but this is of little consolation when we consider that one of the most important types of refraction problems is that of the bilateral aphakic, and high myopes are not uncommon in the ophthalmologist's practice. Nor does it help very much to use a cataract trial set unless it is of the precision type. Almost one half (42.2 percent) of the spheres and sphero-cylinders in the ordinary cataract trial set contained 1.0 to 2.5 diopters of prism; whereas 0.5 percent of the precision lenses contained errors from 1.0 to 1.5 diopters.

The combination of the lenses used during refraction and the rotation of each lens in the trial frames must also be considered. The prism effect which is manifest during examination depends on the rotation of the lens, that is, on just how the lens is placed in the trial frames. This is one explanation of variable phoria findings.

In addition, one must remember that one is dealing with a combination of two lenses, each one perhaps containing a prism.

This paper is not concerned with lateral phorias but only with the vertical type, and one may wonder if those who never prescribe vertical prisms are saving themselves a great deal of trouble. Unless a precision trial set is used, many unnecessary prisms may be prescribed and, even among the supposedly perfect lenses, occasional errors are found.

It would be interesting to check the incidence of decentration in the various types of refracting instruments, but the difficulty of this project lies in the fact that the instruments would have to be taken apart.

Correction of possible errors

In order to correct any prismatic error due to decentered lenses I have adopted the following procedure, which applies only to those cases in which a hyperphoria is found. When the refraction is completed and the hyperphoria is corrected with prisms, the trial frame containing all elements is placed in the vertometer without disturbing the lenses. The vertical prism reading, as found in this instrument, is then assumed to be correct, and represents the patient's true hyperphoria at that time.

Summary

1. A false reading may be introduced by decentered trial lenses when measuring hyperphoria.

2. Out of 568 nonprecision test lenses, 244 (42.9 percent) were decentered 0.5 prism diopter or more.

3. Out of 580 precision trial lenses 75 (12.9 percent) were decentered 0.5 prism diopter or more.

4. Decentered lenses were also found in two cataract trial case sets.

5. Before prescribing a vertical prism, it seems wise to check the prism effect of spheres, cylinders, and prisms used to neutralize hyperphoria. This may be done by transferring the trial frame containing all these elements to a lensometer and taking a final reading of vertical prism, if any.

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MALIGNANT LYMPHOMA OF THE UVEAL TRACT*

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An interesting diagnostic problem is presented by a case of malignant neoplasm with ocular manifestations. In the early stages of the disease the lesion was misinterpreted as inflammatory, and it was not until the enucleated eye was examined pathologically that the proper diagnosis was made. The disease from which the patient suffered was of a general systemic nature; yet for several months the only signs and symptoms were ocular, and for this reason the case should be of interest to ophthalmologists.

CASE REPORT

The patient was a 27-year-old white man, who, in November, 1947, had begun to have pain and blurring of vision in the right eye. He consulted an ophthalmologist who instituted treatment for iritis. When after a month the iritis had not improved but continued to progress, he was referred to us.

There had been no attack of pain, no redness or blurring of vision in either eye preceding the "inflammatory" condition for which he had been receiving treatment. The past history was negative except for two significant events.

In 1944, while attending a radar school at Boston, the patient was hospitalized for an illness characterized by swelling of the lymphatic structures of the groin, diagnosed "lymphangitis." In the following year, when he was stationed at Okinawa, jaundice and severe headaches were the prominent symptoms in another illness for which he was sent to the hospital. During this time his weight, which on induction to the service had been 199 pounds, dropped to 180, and from then on he had experienced a very gradual but persistent loss of weight.

When the patient was first seen, the left eye was normal and it remained so throughout the course of the illness. Vision with the right eye was 20/25. There was a mild ciliary flush.

Slitlamp examination revealed numerous mutton-fat keratic precipitates on the corneal endothelium and cells in the aqueous. The iris was thickened but not nodular, and the blood vessels were engorged. The pupil was moderately dilated, and there were no posterior synechias.

The fundus was easily seen. There was considerable edema of the optic nervehead and the surrounding retina. The retinal veins were moderately engorged and exhibited periphlebitic changes. Throughout the fundus, but particularly in the upper temporal quadrant, were numerous retinal hemorrhages. The vitreous was free of hemorrhage. The intraocular pressure was 50 mm. Hg (Schiøtz).

The diagnosis was neuroretinitis, retinal periphlebitis, and retinal hemorrhage (Eales's disease to be ruled out), iridocyclitis, and secondary glaucoma. The patient was admitted to Harper Hospital where paracentesis controlled the glaucoma.

The inflammatory condition of the eye continued unchecked in spite of energetic treatment during the 10 days the patient remained in the hospital. The iris became more thickened, and it was impossible to keep the pupil dilated. Posterior synechias developed. Large nodules, three to four mm. in diameter, began to form in the iris, and the anterior chamber became shallower as the thickening of the iris increased. In general, the appearance of the anterior segment suggested a chronic granulomatous process, and it was thought that the etiologic factor might prove to be tuberculosis, brucellosis, Boeck's sarcoid, or one of the other chronic granulomas.

While the patient was in the hospital, a thorough survey failed to provide a clue to the etiology. No foci of infection were found. Roentgenograms of the chest were normal. Skin tuberculin and brucel-

* Presented as a clinicopathologic case report at the 55th annual session of the American Academy of Ophthalmology and Otolaryngology, October, 1950, Chicago, Illinois.

† By invitation.

Fig. 1 (Cooper and Riker). Diffuse infiltration of the uveal tract, retina, and epibulbar tissues by tumor cells. (×4. A.F.I.P. Accession 205805.)

lergin tests, the Frei test, blood agglutination test for tularemia and brucellosis, and smears of the prostatic secretion gave no positive information. Kahn test, urinalysis, and routine blood counts were normal. The differential leukocyte count was repeated twice and neither time was it unusual.

The only abnormal findings in the physical examination was moderate bilateral inguinal lymphadenopathy with no tenderness. Biopsy of an inguinal lymph node was done, and the pathologist's report was "chronic lymphadenitis of undetermined character—no evidence of sarcoidosis." In short, nothing was found to which the iridocyclitis or neuroretinitis could be attributed.

Following the patient's discharge from the hospital the iridocyclitis progressed. The iris nodules became larger for a time and then gradually grew smaller. Dense posterior synechias and a pupillary membrane formed, so that the fundus could not be examined. In February, 1948, vision was reduced to perception of hand movements. The intraocular pressure was subnormal. A course of streptomycin therapy was given without any apparent effect on the disease.

In March, because the eye was hopelessly blind and was rapidly becoming a cosmetic defect, and also because it seemed impossible to establish the correct diagnosis without pathologic study, the eye was enucleated. No difficulty was experienced except that dissection of the conjunctiva and isolation of the rectus muscle tendons were hampered by considerable thickening and brawny induration of the conjunctiva, episcleral tissue, and Tenon's capsule. The patient's total leukocyte count during this hospital stay did not exceed 9,500, and the differential count was normal.

During the following six months the patient's condition gradually declined. In May, a painless

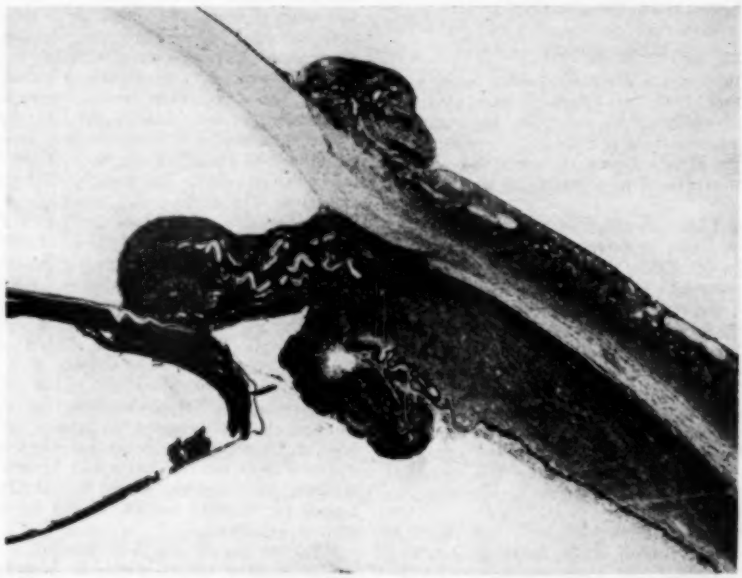

Fig. 2 (Cooper and Riker). Dense neoplastic infiltration with thickening of the conjunctiva, iris, and ciliary body. ×16. A.F.I.P. Accession 205805.)

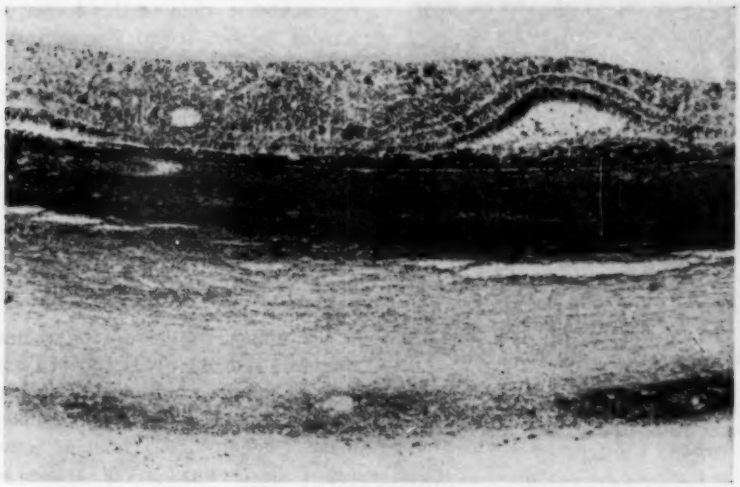

Fig. 3 (Cooper and Riker). Tumor cells with large nucleolated nuclei in the ciliary body. (×705. A.F.I.P. Accession 205805.)

swelling of the right testicle suddenly appeared. It was relatively soft and uniformly smooth with no nodularity, and attained the size of a peach. This was the first clinical indication (unless the inguinal lymphadenopathy can be considered) of generalized disease. The testicle was removed and studied pathologically. At this time the differential blood count was normal. The liver and spleen were palpable and there were no indications of lymphadenopathy. Later the same month a cervical lymph node was removed and studied.

The treatment of the eye in the early stages of the disease included all accepted measures, both local and general, for severe uveitis. It was not until June, 1948, when the pathologic diagnosis of neoplasm in the eye had been further confirmed by examination of the testicular tumor, that deep roentgen therapy was begun.

Irradiation was directed not only to the orbit and the testicle but also to all of the lymph-node areas which might constitute potential foci of metastasis, and to the pelvis, abdomen, and mediastinum. Supervoltage roentgen rays were employed over all of the areas except the two axillas, where deep roentgen therapy was used.

In July, 1948, the total leukocyte count was 4,500 and the differential count was normal. In the terminal stages of the illness the other testicle became involved, and there was clear-cut clinical and radiologic evidence of massive involvement of all the deep lymphatic structures of the abdomen, thorax, neck, and head. The patient died in October, 1948. Autopsy was not permitted.

Pathologic observations*

The enucleated eye was sent to the Armed Forces Institute of Pathology, and a report received in April, 1948, gave the first indication that the lesion was malignant. The conjunctiva, episclera, uveal tract, retinal

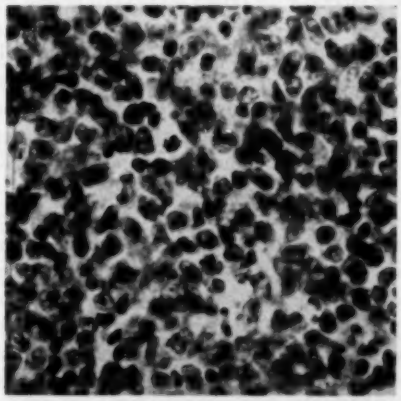

Fig. 4 (Cooper and Riker). Reticulum fibers surrounding tumor cells in the ciliary body (Wilder reticulum stain). (×453. A.F.I.P. Accession 205805.)

* Pathologic reports furnished by Helenor Campbell Wilder, Registry of Ophthalmic Pathology, Armed Forces Institute of Pathology, Washington, D.C.

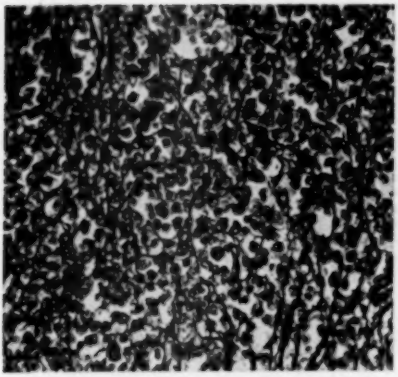

Fig. 5 (Cooper and Riker). Infiltration of the choroid and retina by tumor cells with partial destruction of retinal architecture. (×48. A.F.I.P. Accession 205805.)

pigment epithelium, sensory retina, and optic nerve were infiltrated with closely packed cells (figs. 1 and 2).

These sometimes resembled lymphocytes, having small round, deeply staining nuclei and scanty cytoplasm which was not always discernible. More often, however, the cells were larger, with rather abundant, ill-defined cytoplasm and large, oval or round, vesicular, nucleolated nuclei (fig. 3). These large cells approximated in appearance the cells of the germinal center of lymph follicles. A reticulum stain demonstrated a close association between the reticulum fibers and tumor cells in many areas (fig. 4).

There were anterior and posterior synechias and a pupillary membrane. The lens showed subcapsular degeneration and wrinkling of the capsule. The retina was separated and folded in several places, and there was almost total loss of normal retinal architecture (fig. 5). The diagnosis was lymphoid tumor, probably metastatic reticulum-cell sarcoma.

The lesion of the inguinal node which was removed when the patient was first hospitalized for treatment of the eye was diagnosed by the Harper Hospital pathologist as chronic lymphadenitis (fig. 6). Following the identification of the ocular neoplasm, a representative slide of this lesion was forwarded to the Armed Forces Institute of Pathology. The diagnosis of lymphadenitis was concurred in, although it was regarded as possible that the process represented an inflammatory reaction to adjacent neoplasm.

A microscopic slide of the testicle was submitted to the Armed Forces Institute of Pathology. It also revealed malignant tumor composed of small cells with scanty cytoplasm and round, deeply staining nuclei (figs. 7 and 8).

The tumor in the eye more nearly resembled reticulum-cell sarcoma, although that in the testicle had the appearance of lymphosarcoma. It is not always possible to make a definite differentiation between the two. Cells of reticulum cell sarcoma resemble the large cells in the germinal center of the lymph nodes, whereas a lymphosarcoma is composed of cells resembling the small cells of the node. Both have an origin from undifferentiated cells, and the variation results from the type of differentiation.

The cervical lymph node, which was removed after the testicle, was studied elsewhere. The report stated that there was entire loss of normal architecture, the node being invaded by tumor cells similar to those in the eye.

Comment

Lymphoid tumors arising within the eye-

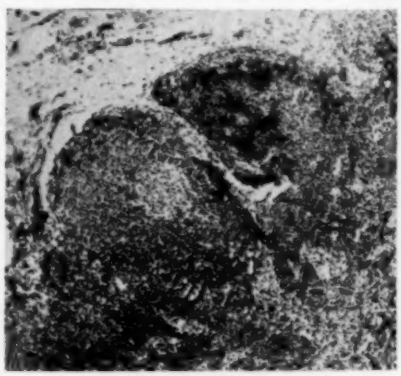

Fig. 6 (Cooper and Riker). Reactive inguinal lymph node. (×76. A.F.I.P. Accession 205805.)

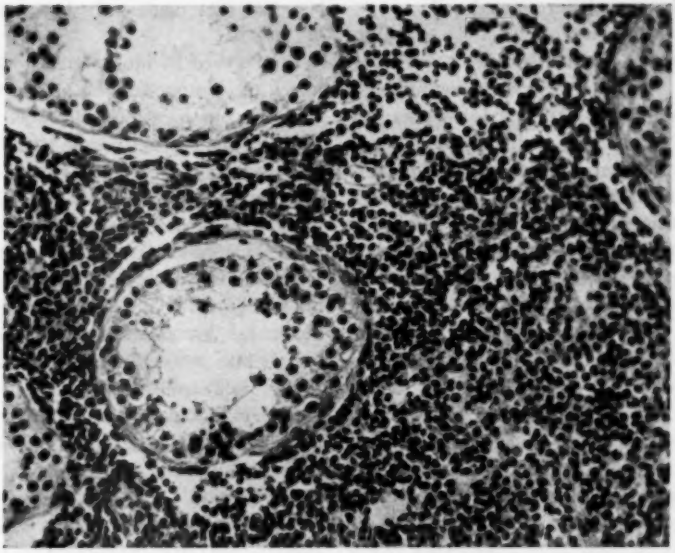

Fig. 7 (Cooper and Riker). Interstitial invasion of the testicle by tumor cells resembling lymphocytes. (×435. A.F.I.P. Accession 205805.)

ball have seldom been described in the literature. In a report of 21 verified cases of lymphoid disease involving the eye and its adnexa, McGavic[3] found only one within the globe as against 20 which involved the lids, conjunctiva, or lacrimal gland. In Heath's series[2] of 67 ocular lymphomas, the globe was involved in only three. Sugarbaker and Craver,[4] reporting on 196 cases of lymphosarcoma, stated, "It is logical to suppose that lymphosarcoma is a disease which in the majority of cases begins and runs its early course in lymph nodes alone." In most instances of rapidly disseminating disease, it is impossible to determine whether a given organic involvement is secondary or primary.

Lymphoid tissues composed of follicles and sinuses do not exist in the eyeball or within the orbit, nevertheless, lymphoid tumors arising within the orbit are by no means unknown. They also occur in other locations where lymphoid tissues are not found normally, particularly in the skin where they are regarded as arising from undifferentiated cells around blood vessels. Possibly this tumor was primary in the eye, but the early episode of inguinal gland enlargement cannot be ignored. According to the pathologic reports from the Armed Forces Institute of Pathology, it more probably represented either metastasis from elsewhere in the body or one manifestation of a tumor arising in disseminated lymphatic

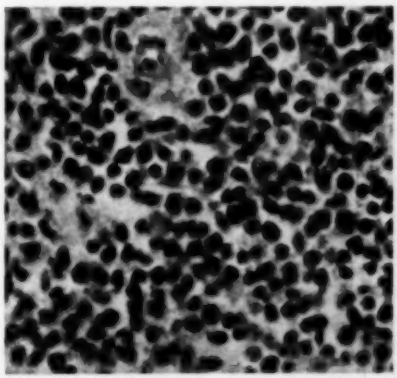

Fig 8 (Cooper and Riker). Small tumor cells resembling lymphocytes in the testicle. (×655. A.F.I.P. Accession 205805.)

tissue and from undifferentiated cells.

As is often the case, an exact classification of the tumor in this instance is impossible; it includes features of both reticulum-cell sarcoma and lymphosarcoma. However, all malignant lymphomas, including Hodgkin's disease and the lymphoid leukemias, are considered manifestations of the same disease[1] and it is not unusual for them to exhibit a variable pattern in a single patient. The neoplastic process may be represented in one organ as giant follicular lymphoblastoma and in another as lymphosarcoma, or a tumor starting as Hodgkin's disease may terminate as lymphosarcoma, the transition being readily traceable in successive biopsies.

It is impossible to evaluate the causes which may incite lymphoid tissue to malignant growth. The history of our patient presents two episodes, one in 1944, the other in 1945. Although both were interpreted at the time as infectious, it cannot be proved or assumed that an inflammatory process preceded the neoplasm.

There is no specific hemogram in lymphosarcoma, and usually, when blood changes do occur, they are late in the disease and may be ascribed to radiation therapy. The only abnormality in the blood picture was moderately low hemoglobin late in the disease, and at no time did the patient have an abnormal leukocyte or differential count, although the last test was made only two weeks before his death.

It is agreed by most writers that the diagnosis of lymphosarcoma cannot be made clinically but must be established by biopsy. Early in the clinical course even biopsy may show what appears to be a reactive or benign proliferation of lymphoid tissues. Considering the important part played in inflammations by lymphocytes, it is sometimes difficult to evaluate their significance as part of an inflammatory or neoplastic process.

As far as treatment is concerned, all lymphomas are radiosensitive but not necessarily radiocurable. Obviously, the earlier treatment is begun, the better is the chance of cure, but the prognosis is usually poor.

Summary

The malignant lymphoma involving the eye in the case presented was probably either metastatic or part of a widely disseminated lymphoid activity. The ocular process presented symptoms which simulated typical uveal inflammation, and the proper diagnosis was made only upon pathologic examination of the enucleated eye.

In any case of severe uveitis with nodular iritis or retinal hemorrhages for which no cause is found and which does not respond to treatment, it is important to consider the possibility of malignant lymphoid disease.

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A STUDY OF THE ELECTRICAL RESISTANCE PROPERTIES OF CORNEAL EPITHELIUM*

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Measurements of the electrical impedance of beef corneas as an aid in the study of corneal permeability have been made by Holt and Cogan.[1] Similar studies were carried out by Friedenwald and others.[2] These authors showed that the resistance of the cornea to the passage of an electric current was due almost entirely to the epithelial layer. Any interruption in the continuity of the epithelium produced a marked fall in the resistance. In the measurements of Holt and Cogan, the resistance of the stroma alone averaged about six ohms, whereas that of the epithelial-stroma combination averaged about 400 ohms.

The present study proposes to determine whether this resistive property resides in the epithelium itself or in the bond between the epithelium and the stroma.

Studies on the adhesiveness of the epithelium to the stroma by Herrmann and Hickman[3] concluded that the cohesive force is probably due to the attraction of nonpolar hydrocarbon residues in the boundary surface and that the coherent surface may be a protein-lipoid multilayer. They further concluded that the maintenance of the coherent organization may require metabolic energy.

Herrmann[4] also showed that histamine in high dilutions caused a loosening of the corneal epithelium between the basal epithelial cell layer and the overlying epithelium. This occurred only after incubation for some hours. An acid-base linkage across the stroma-epithelial boundary could not explain epithelial cohesion because loosening did not occur below pH 10 and this would be compatible only with an acid-base linkage if the isoelectric point of the proteins was above 10, which is unlikely. Heavy alcohols, however, are extremely efficient in loosening the epithelium and this suggests the presence of a lipoidal component in the corneal film.

Kinsey[5] applied the Danielli scheme of surface layers of cells as a tentative explanation of the adhesiveness of the layers of the epithelium and the loss of adhesiveness after treatment with butyl alcohol. In a coherent film the protein of the epithelium is bridged to the protein of the stroma by a double lipoid layer, each part of which has a hydrophilic head and a hydrophobic tail. According to this scheme, butyl alcohol disrupts the film by attacking the hydrophobic tails.

METHOD

Whole beef eyes were obtained immediately after death and tested by fluorescein to demonstrate the intactness of the epithelium. The fluorescein was promptly washed off with normal saline and the cornea fastened to the electrolyte cell, epithelial side down. The maximum time that elapsed from killing the animal to the use of the cornea was two and one-half hours.

We used a modified form of the Wheatstone bridge, model RC 1B, manufactured by the Industrial Instrument Company of New Jersey. This is a null-balance type AC Wheatstone bridge with low-voltage bridge source, single stage vacuum tube amplifier, and electron ray "eye" tube null indicator.

The resistance readings are independent of source voltage fluctuations and vacuum-tube characteristics. Readings were all taken with 1,000 cycle AC in order to eliminate significant polarization. Two identical cells were used and readings were taken at room temperature.

* From The Eye Bank for Sight Restoration, Inc. Aided by grants from the Millbank Memorial Fund.

TABLE 1

AVERAGE RESISTANCE OF SIX CORNEAS

Cornea Number	Epithelium Intact	Scraped Off	Difference
1	75	25	50
2	85	20	65
3	95	25	70
4	115	65	50
5	95	35	60
6	95	45	50

The voltage of our bridge-source oscillator was just less than three volts. We were aware that this was considerably more than the voltage used by Holt and Cogan, who kept their input down to approximately 10 millivolts in order to avoid stimulation or damage to the tissue. However, the apparatus that we used was available and, after a thorough trial, we concluded that the three-volt bridge input did not materially alter our readings and that consistent results could be obtained.

TABLE 2

INFLUENCE OF STORAGE ON AVERAGE RESISTANCE

No. corneas	6
Epith. intact	95
(Hours)	(Reading)
0.5	−17
1.0	−17
1.5	−17
2.0	−20
2.5	−30
3.0	−30
3.5	−30
24	−42

The resistance components of the impedance measurements were used for this study because it was felt that this was the simplest adequate method. The electrolyte solution was 0.9-percent saline and this was used in sufficient amounts to cover both electrodes with the cornea suspended between them. Blank readings were taken to standardize resistance measurements of the solution in the cell itself and this was checked between trial runs.

The resistance of epithelium and stroma together was compared with that of stroma alone after the epithelium was scraped off with a knife blade. The effect of change in temperature on resistance was measured. The change of resistance with passage of time while the cornea was stored in 0.9-percent saline at room temperature was recorded. Resistance measurements were made after immersing the intact epithelium in various chemical substances as noted below.

After the resistance studies were completed, the corneas were fixed and sections were made for histologic examination.

RESULTS

PHYSICAL

1. *Scraping.* The average resistance of six corneas fell from 95 to 36 ohms, a drop of 57 (table 1).

TABLE 3

INFLUENCE OF INCREASE OF TEMPERATURE ON AVERAGE RESISTANCE

No. corneas	6
Epith. intact	146
(Degrees)	(Reading)
5	− 6
10	−28
20	−34
25	−34
30	−35
35	−36
40	−42
45	−44
50	−52

2. *Storage.* The average fall in resistance with the cornea immersed in saline in the cell at room temperature was 17 ohms in the first half hour, then a plateau was reached for one and one-half hours and the resistance began to fall again more gradually (table 2).

3. *Temperature.* (a) Resistance diminished as temperature increased (table 3). The values are corrected for the change in the cell resistance with increase in temperature and also for the decline of resistance of the cornea with storage.

TABLE 4

INFLUENCE OF DECREASE OF TEMPERATURE ON AVERAGE RESISTANCE

No. corneas	6
Epith. intact	116
(Degrees)	(Reading)
20	+10
15	+27
10	+51
5	+58

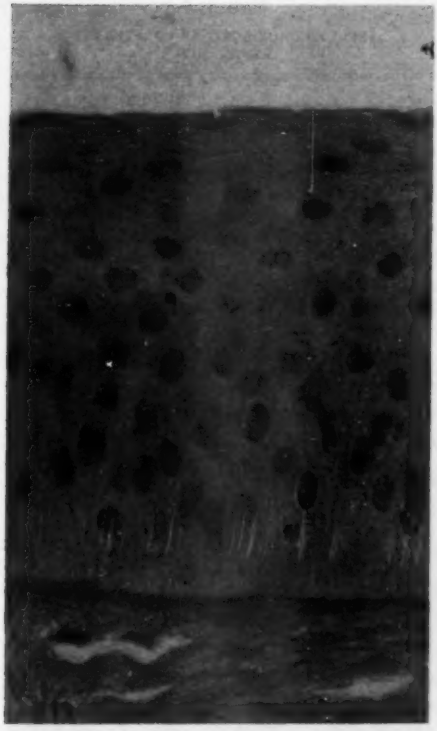

Fig. 1 (Katzin). Normal cornea.

b. Resistance increased as the temperature fell (table 4). This table is also corrected for the change in the resistance of the cell as well as the storage decline.

CHEMICAL

Corneas (fig. 1) were immersed for various periods of time in the following chemicals and readings were taken:

4. *Ether*—two-, five-, and 10-minute (fig. 2) immersion, all produced a marked drop in resistance (table 5). Immersion for one-half minute produced little effect.

Histologically, the cytoplasm of the cells was affected in such a manner that separation of the epithelium occurred in the cytoplasm in layers. The nuclei appeared relatively normal.

In one-half-minute immersion, there was little effect on the epithelium. After two

TABLE 5

INFLUENCE OF ETHER ON AVERAGE RESISTANCE

	Ether		
	2 min.	5 min.	10 min.
No. corneas	2	2	2
Epith. intact	90	85	97
Immed.	−55	−65	−70
(Hours)			
0.5	−55	−72	−72
1.0	−65	−77	−74
1.5	−68	−80	−75
2.0	−68	−80	−75
2.5	−68	−80	−75
3.0	−68	−80	−75
3.5	−68	−80	−75
24	−73	−86	−85

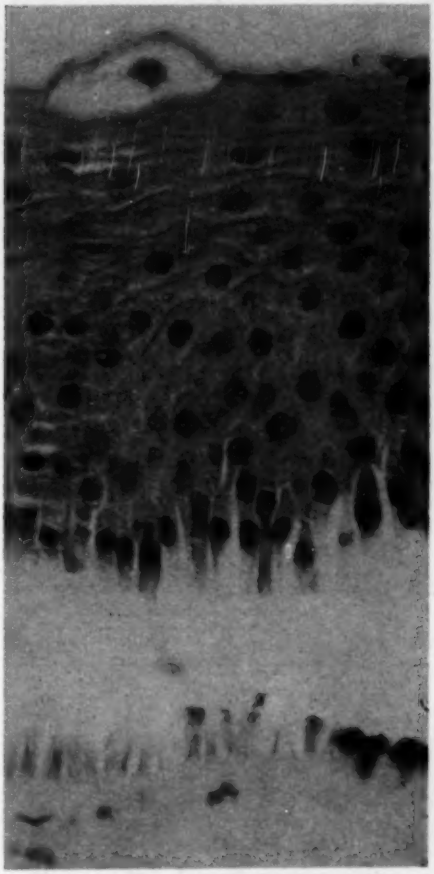

Fig. 2 (Katzin). After 10-minute immersion in ether

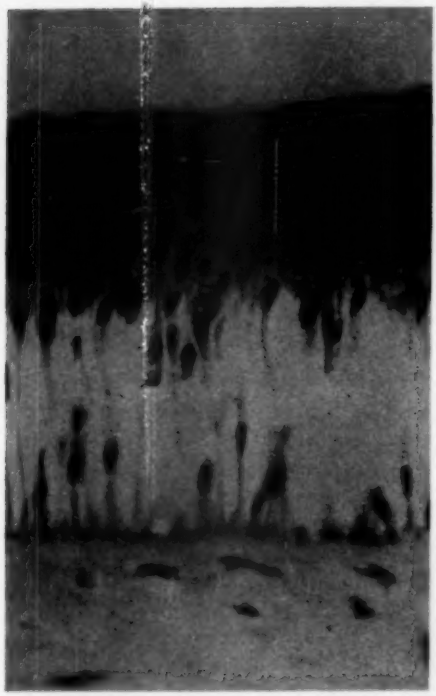

Fig. 3 (Katzin). After 45-second immersion in chloroform.

minutes, the epithelium was divided approximately in halves and, after five minutes, ether had penetrated to the basal cell layer, which was disrupted with detachment of the entire epithelium. The 10-minute immersion produced more complete separation of the basal cell layer.

TABLE 6

INFLUENCE OF CHLOROFORM ON AVERAGE RESISTANCE

	Chloroform		
	15 sec.	30 sec.	45 sec.
No. corneas	2	2	2
Epith. intact	105	85	107
Immed.	−65	−60	−90
(Hours)			
0.5	−75	−65	−90
1.0	−75	−65	−90
1.5	−75	−65	−98
2.0	−75	−65	−98
2.5	−75	−65	−98
3.0	−75	−65	−98
3.5	−75	−65	−98
24	−90	−70	−98

TABLE 7

INFLUENCE OF ACETONE ON AVERAGE RESISTANCE

	Acetone		
	2 min.	10 min.	20 min.
No. corneas	2	2	2
Epith. intact	135	105	95
Immed.	−90	−105	−80
(Hours)			
0.5	−90	−108	−80
1.0	−90	−108	−80
1.5	−90	−108	−80
2.0		−108	−80
2.5		−108	−80
3.0		−108	−80
3.5		−108	−80
24		−120	−85

5. *Chloroform*—15-, 30-, and 45-second

Fig. 4 (Katzin). After 20-minute immersion in acetone.

TABLE 8

INFLUENCE OF ETHYL ALCOHOL ON AVERAGE RESISTANCE

	Alcohol				
	(2.5 molar)	(5.0 molar)	(10 molar)		
	20 min.	20 min.	5 min.	10 min.	15 min.
No. corneas	6	6	2	2	2
Epith. intact	97	84	97	75	90
Immed.	−14	−25	−20	−17	−33
(Hours)					
0.5	−21	−25	−26	−46	−52
		(Scraped)			
1.0	−19	−25	−53	−46	−72
1.5	−19	−25	−47	−46	−75
2.0	−19	−25	−47	−46	−75
2.5	−19	−25	−47	−46	−75
3.0	−26	−25	−47	−46	−75
3.5	−26	−25	−47	−46	−75
24	−28	−38	−53	−48	+86

(fig. 3) immersion. Chloroform behaved in a manner similar to ether, but more quickly (table 6). A marked resistance fall occurred after 15 seconds.

Histologically, one-half minute immersion produced complete separation of the upper one-third of the epithelium. The basal layers fragmented after 45 seconds' immersion. The nuclei were more shrunken than with ether.

6. *Acetone*—two-, 10-, and 20-minute (fig. 4) immersion—all produced a very marked drop in resistance (table 7).

Histologically, acetone dissolved something out of the cytoplasm so that the cells had a blown-up appearance and the nuclei were shrunken and dark-staining. The blown-up appearance of the cytoplasm was more marked in the sections that were immersed for longer periods, but disruption was not so marked as it was with ether, and the epithelium did not tend to detach.

7. *Ethyl alcohol*—2.5-molar concentration, 20 minutes' immersion, produced no significant change in resistance (table 8). Histologically, the superficial layers of the corneal epithelium showed cytoplasmic swelling.

Ethyl alcohol—5.0-molar concentration, 20 minutes' immersion, produced a slight fall in resistance (table 8). Histologically, the effect on the cytoplasm of the cells was more

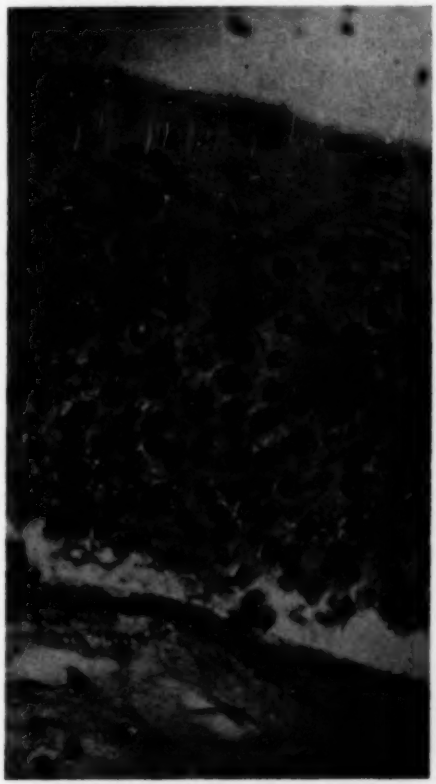

Fig. 5 (Katzin). After 30-minute immersion in butyl alcohol (0.5-molar concentration).

TABLE 9

INFLUENCE OF BUTYL ALCOHOL ON AVERAGE RESISTANCE

	Butyl Alcohol (0.5 molar)		Butyl Alcohol (pure)		
	5 min.	30 min.	2 min.	5 min.	10 min.
No. corneas	6	6	2	6	2
Epith. intact	99	115	125	103	135
Immed.	− 1	−18	−72	−92	−110
0.5 hour	−16	−32	−83	−95	−117

marked and there was separation of cells. In addition, there were small cytoplasmic vacuoles in the basal layer.

Ethyl alcohol—10-molar concentration—was used for three immersion time periods, five, 10, and 15 minutes (table 8). There was a greater fall in the resistance for longer periods of immersion. After the one-half hour reading was taken, the epithelium was scraped to see whether the alcohol had produced a maximum fall in the resistance (table 8). Histologically, there was some cytoplasmic disruption of the basal cell layers and vacuolization in the lower one half of the epithelium. The nuclei were somewhat dark-staining.

TABLE 10

INFLUENCE OF XYLOL ON AVERAGE RESISTANCE

	Xylol		
	5 min.		30 min.
No. corneas	2	6	6
Epith. intact	115	108	84
Immed.	−10	−11	− 9
(Hours)			
0.5	−20	−24	−46
1.0	−25		
1.5	−35		
2.0	−35		

8. *Butyl alcohol*—0.5-molar concentration, five and 30 minutes' (fig. 5) immersion, produced no significant changes in resistance (table 9). Histologically, there was little effect until after 45 minutes when the basal cell layer began to separate by cellular disruption.

Butyl alcohol (pure)—two-, five- and 10-minute immersion, produced a marked fall in resistance (table 9). Histologically, there was shrinkage and dark staining of the nuclei and separation of the epithelium from the stroma with protein precipitation in between.

9. *Xylol* was used in five- and 30-minute immersion periods. Only after 30 minutes' immersion, was there a significant change in resistance (table 10). Histologically, the picture was not much affected, although after 30 minutes there was a few vacuoles in the basal layer.

10. *Benzol* was used in 15-, 30- and 45-minute (fig. 6) immersion periods and there was a marked fall in resistance (table 11). Histologically, benzol caused shrinkage of the nuclei and irregular confluence of cytoplasm vacuoles.

Fig. 6 (Katzin). After 30-minute immersion in benzol.

TABLE 11

INFLUENCE OF BENZOL ON AVERAGE RESISTANCE

	Benzol		
	15 min.	30 min.	45 min.
No. corneas	2	2	2
Epith. intact	105	95	120
Immed.	−35	−30	−70
(Hours)			
0.5	−65	−64	−75
1.0	−65	−65	−75
1.5	−65	−66	−75
2.0	−65	−66	−90
2.5	−65	−66	−95
3.0	−65	−66	−95
3.5	−65	−66	−95
24	−80	−75	−106

11. *Benzine*—(petrol ether) was used for five-, 10-, and 20- (fig. 7) minute immersion periods. The drop in resistance was not significant (table 12). Histologically, there was little effect on the epithelium.

12. *Paraldehyde*—The resistance fell off moderately, after five- (fig. 8), 20-, and 30-minute immersion periods (table 13). Histologically, the epithelium was separated from the stroma with a protein precipitate. There was also vacuolization of the basal cells.

13. *Chloral hydrate* (fig. 9) was used for five-, 20-, and 30-minute immersion periods. There was a moderate drop in resistance (table 14). Histologically, there was separation of the stroma from the epithelium through the basal layer with disruption of the cytoplasm of this layer.

14. *Novocaine* (two percent) and *pontocaine* (two percent). The immersion period for both was 20 minutes. There was little appreciable effect on the resistance and none on the histologic picture (table 15).

TABLE 12

INFLUENCE OF BENZINE (PETROL ETHER) ON AVERAGE RESISTANCE

	Benzine		
	5 min.	10 min.	20 min.
No. corneas	6	6	6
Epith. intact	116	87	83
Immed.	− 7	−10	− 8
0.5 hr.	−20	−13	−10

TABLE 13

INFLUENCE OF PARALDEHYDE ON AVERAGE RESISTANCE

	Paraldehyde		
	5 min.	20 min.	30 min.
No. corneas	2	2	2
Epith. intact	120	120	105
Immed.	−28	−53	−43
(Hours)			
0.5	−30	−55	−43
1.0	−28	−55	−58
1.5	−26	−55	−58
2.0	−26	−55	−58

15. *Cocaine* (four percent). After 20 minutes' (fig. 10) immersion, there was no appreciable change in the resistance (table

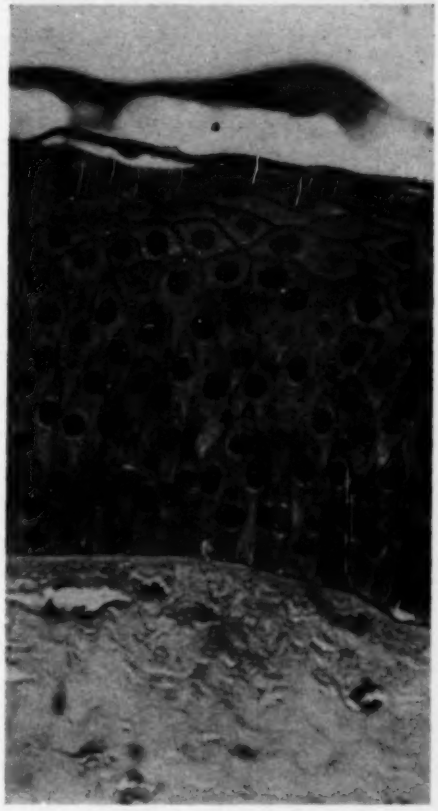

Fig. 7 (Katzin). After 20-minute immersion in benzine (petrol ether).

TABLE 14

INFLUENCE OF CHLORAL HYDRATE ON AVERAGE RESISTANCE

	Chloral Hydrate		
	5 min.	15 min.	30 min.
No. corneas	4	2	2
Epith. intact	83	80	85
Immed.	−51	−60	−70
(Hours)			
0.5	−52	−55	−65
1.0	−52	−55	−65
1.5	−56	−55	−60
2.0	−65	−55	−55

Fig. 8 (Katzin). After five-minute immersion in paraldehyde.

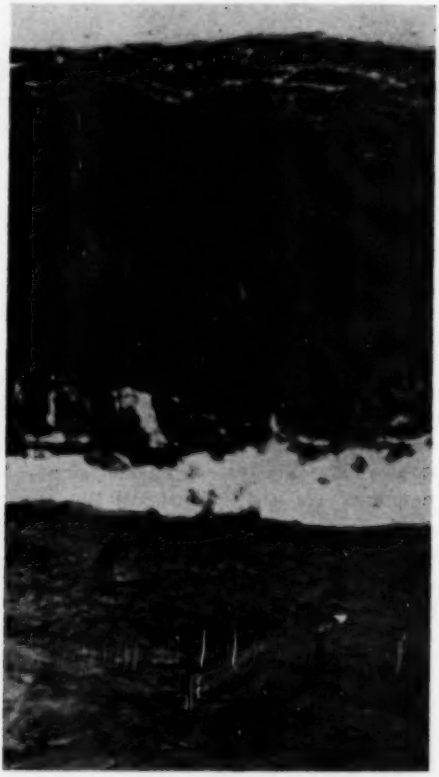

Fig. 9 (Katzin). After 20-minute immersion in chloral hydrate.

15). Histologically, there was some separation from the stroma with a protein precipitate in between, and some loss of demarcation of cell boundaries was noted.

COMMENT

There was a moderate variation in the resistance readings both initially with the epithelium intact and in the final reading. For example, when the corneas were scraped (table 8), the individual findings were representative.

The fall in resistance was not so marked following scraping as was noted by Holt and Cogan. However, the physical constants of our apparatus and our electrolyte cell were different from theirs.

The diminution of corneal resistance with storage at room temperature represented a gradual deterioration of the epithelium. The changing resistance of the cornea with changes in temperature is a complex of temporary and permanent changes. When the temperature of the cornea was initially raised, the resistance kept falling off; on the other hand, when the temperature was raised first and then lowered, if it was brought above the temperature of the room, the findings were inconsistent.

Ether dissolved some substance out of the cytoplasm which led to separation of the cells. Chloroform acted in a similar but more drastic manner and caused some shrinkage of the cellular nuclei. Acetone appeared to dissolve something out of the cytoplasm which resulted in a blown-up appearance but no separation of the cells themselves.

Ethyl alcohol did not produce a very marked change in the resistance. The five-molar concentration of ethyl alcohol had the greatest effect on the histologic appearance. This is a known phenomenon, Buschke.[6] Butyl alcohol in small concentration produced little effect unless the immersion time was quite long. Pure butyl alcohol, on the other hand, had a marked effect on both the resistance and the histologic picture. It rapidly separated the epithelium from the stroma.

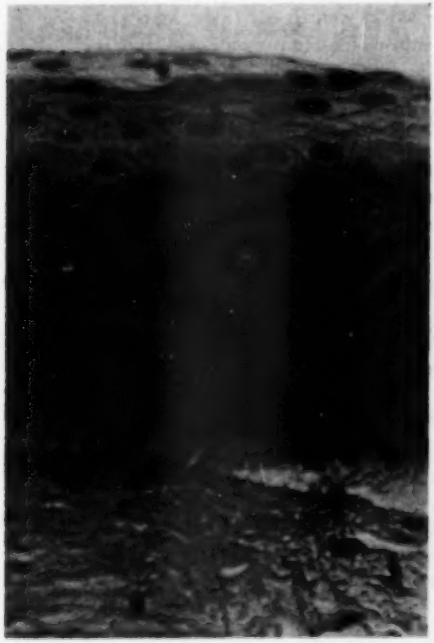

Fig. 10 (Katzin). After 20-minute immersion in four-percent cocaine.

TABLE 15

INFLUENCE OF NOVOCAIN, PONTOCAINE, AND COCAINE ON AVERAGE RESISTANCE
(Immersion twenty minutes)

	Novocain (2 percent)	Ponto-caine (2 percent)	Cocaine (4 percent)
No. corneas	6	6	6
Epith. intact	150	92	135
Immed.	−24	−31	− 2
(Hours)			
0.5	−36	−34	−15
1.0	−36	−28	−15
1.5	−32	−34	−15
2.0	−32	−34	−15
2.5	−34	−36	−15
3.0	−33	−36	−15
3.5	−33	−36	−15
24	−42	−50	−38

Benzine had little effect. Xylol and benzol produced a moderate fall in the resistance and a moth-eaten appearance of the epithelium which penetrated to the lowest layers after 30 minutes. Paraldehyde and chloral hydrate produced a moderate fall in the resistance with disruption of the basal cell layer.

Novocain and pontocaine had no appreciable effect. Cocaine caused some separation of the epithelium from the stroma without very much resistance drop.

SUMMARY AND CONCLUSION

A study was made of the electrical resistive properties of beef corneas as affected by various physical and chemical agents.

Histologic sections were made to correlate these effects.

From the observations noted, it is concluded that the entire epithelium partakes in the property of the cornea that causes resistance to the alternating electric current. Substances which will cause a disturbance

of the epithelial layer without separating it from the stroma can still quite markedly reduce electric resistance. It is believed that the epithelial-stroma bond is not alone responsible for the resistance property.

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Ophthalmic Miniatures

Of all the human faculties, sight is the most perfect and the structure of the eyes is the most admirable in the body of man. His eyes are like the sun and moon in the sky, for the eyes are the suns of the human body, the beauty and loveliness of the face, the windows of the soul, and the joy and fineness of nature.

And thus we see, the Divine Artisan, creating this miraculous microcosm in his mother's womb, this little world we call our body, leaves as His last task the making of our eyes, into which He puts the rest of His infinite wisdom; which David meant when he said: "Oh, Lord, marvelous is Thy wisdom in the making of my body."

Introduction to Chapter 1 of Benito Daca de Valdes's
Book on Refraction (1623).
(Translation by Anthony Bove.)

Light passes forward in transparent bodies on rectilinear paths, and indeed it passes along such paths only; and it proceeds from every point of the luminous body in the direction of every straight line which can be drawn from such point. The passing forward of the light along straight paths is made entirely clear by the light which enters through a chink into a dark room. The light from the chink is found extending to the floor or to the wall which is opposite to the chink along straight lines. . . . So it is the special property of light which moves it along straight paths, and the special property of transparency that it does not hinder the penetration of light into transparent bodies.

Alhazen, *On Light*, (about 1000 A.D.)
From the translation by Baarman.

NOTES, CASES, INSTRUMENTS

THE HEAD-TILT TEST FOR THE AXIS OF ASTIGMATISM

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Several years ago, a patient remarked to me that the right lens of the new glasses that I had prescribed for her did not give her clear vision. She observed that her vision improved when she tilted her head toward her right shoulder. Her glasses measured: R.E., +2.0D. sph. ⊃ +1.0D. cyl. ax. 80°; L.E., +2.75D. sph. My prescription for the right lens had called for the axis at 90 degrees.

About this time, I was interested in studying the role of the head-tilt in vertical muscle palsies.[1] Every head-tilt is accompanied by a compensatory reflex parallel torsion of both eyeballs in the opposite direction. For a head-tilt of 60 degrees, Bárány[2] found the torsion to vary between four and 16 degrees for different subjects, the mean value being eight degrees. Thus, when the head is tilted by an angle of 60 degrees, the eyeballs rotate in the same sense, but only about 52 degrees. In other words, the eyeballs lag behind the head as a whole.

In the aforementioned case, the relationship between the axis of astigmatism and the axis of the spectacle lens was changed by the head-tilt. By tilting her head toward her right shoulder, the axis of astigmatism of the patient's right eye was made to rotate clockwise, or toward the left, that is, away from the 90-degree axis, thus approximating more closely the 80-degree axis of the spectacle lens, with resulting improvement in vision.

I have utilized this principle in a simple test for the precise determination of the axis of astigmatism. The lenses, as determined by the usual methods, are placed in the trial frame. One eye is occluded and the patient's head is titled by about 30 degrees, first toward one shoulder, then toward the other. Care should be taken to avoid any face rotation to either side, since the eye which is being examined must always gaze through the optical center of the lens.

The axis of the cylinder may be assumed to be in the correct position if the clearest vision is obtained with the head erect. If a head tilt to the right improves the vision, the cylinder should be rotated about five degrees to the right and the test repeated. If a head-tilt to the left gives improvement in vision, the axis of the cylinder should be rotated toward the left.

The head-tilt test is especially valuable in high astigmatism, where a one-degree displacement of the axis may have a definite effect on the visual acuity and on the patient's comfort. However, it is of value as an auxiliary check even in cases of astigmatism as low as 0.50 diopter.

I have been unable to find mention of this test in any modern treatise or textbook of ophthalmology, although Javal recognized its usefulness as far back as 1866.[3]

The head-tilt test can be used in several different ways for the determination and verification of the axis of astigmatism:

1. It can be used to corroborate the findings obtained by the cross-cylinder and other methods.

2. When checking the finished glasses against the prescription, the head-tilt test will be found extremely valuable in cases of high astigmatism, since it is a simple, yet sensitive, method. This test is much more satisfactory than the common practice of tilting the spectacles on a patient to determine the best axis.

3. In comparing the refraction for distance with that for near, wide discrepancies will often be found between the axis of astigmatism for distance and that for near, since convergence is associated with a certain amount of extorsion of both eyeballs. Occasionally, this difference is so great that it may be necessary to prescribe a separate pair of glasses for near work. The head-tilt test

will uncover such discrepancies easily and without undue expenditure of time.

4. If a patient has a habitual head-tilt, this should be taken into consideration when prescribing cylindrical lenses; it may not be to the patient's best interest to be given glasses which are based on a refraction performed with the patient's head held in the upright position.

Summary

A simple, practical test is described for the determination and verification of the axis of astigmatism. The test consists in tilting the patient's head toward either shoulder with his glasses in position, either in a spectacle or trial frame. When the axis of the cylinder is in the correct position, the clearest vision should be obtained with head erect.

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HOMONYMOUS HEMIANOPIA*

Bilateral with macular sparing of vascular origin

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Bilateral hemianopia is of traumatic or vascular origin. The majority of the traumatic cases were reported after the two world wars, and the condition was caused by schrapnel or gunshot wounds of the occiput. Industrial accidents involving the occiput have been known to produce the same condition. Birth trauma[6] must be considered when bilateral hemianopia is found in a young person with no other apparent history of trauma.

Hemianopia[5] of vascular origin is usually sudden in onset and is caused by an embolus, thrombosis, or rupture of a vessel supplying the optic pathways in the visual cortex. Such defects are fairly common and, unless complete, frequently pass unnoticed until discovered in a routine examination of the visual fields. The occurrence of bilateral hemianopia with sparing of the macular field is, however, rather rare. It was first reported in this country by Dunn.[3]

* From the Greens' Eye Hospital.

The posterior cerebral artery supplies practically the entire cortex of the occipital lobe with, however, the exception, as a rule, of the posterior pole. Occlusion of the posterior cerebral artery, therefore, results in a crossed homonymous hemianopia in which the macular region, which frequently receives an anastomotic supply from the middle cerebral artery, is spared.

This sparing of the macula, usually over a wide area (5 to 10 degrees), is characteristic of an extensive thrombotic lesion, and it may extend some distance upward or downward in the vertical meridian.

Initially, the fixation area may be bisected and the macula become freed after some days. Occasionally the two sides may be affected in sequence or, rarely, simultaneously, in which event double hemianopia occurs, leaving only a minute central field, corresponding to a bimacular escape. Sometimes this is associated with retention of a restricted portion of the peripheral field, such as the area near the vertical radii, if, in addition to the occipital poles, some portion of the cortex, such as that lying on the medial surface of the brain, remains intact.

Holmes[4] helped work out the geographic distribution of the visual field in the visual cortex. The arguments for and against bi-

lateral representation of the macula can be read in any good textbook of ophthalmology. The macula is represented at the posterior extremity of the occipital lobe, and the wide area of representation probably extends just beyond the margins to the lateral surface. The intervening homolateral field is represented in serial order between these two regions.

In all probability there is considerable individual variation in the cerebral vascular circulation. The extent of the cortical damage in all cerebrovascular accidents varies as to the site and the extent of the lesion and of the anastomotic blood supply.

Report of a case

History. Mrs. A. F., aged 57 years, consulted us for the first time on November 7, 1947, because of inability to get around by herself and to see peripherally; that is, up or down, right or left. Apparently she awoke one morning in October, 1946, with this condition.

Her general physician examined her at home and told her that she may have had a "stroke." She was kept in bed for a few weeks. She had been under treatment for high blood pressure for several years. Some time later she was examined by an optometrist, and glasses were prescribed, but these were of no help.

Later she visited an oculist, who told her that she had pressure on her optic nerves which was causing her present eye condition.

There was no history of any difficulty with speech or of any spatial disorientation or functional disturbances.

Examination. Neurologic examination gave negative findings. Laboratory studies, including a complete blood count, urinalysis, and Wassermann and Kahn test of the blood, gave normal results. The blood pressure was 252/104 mm. Hg. Blood-pressure readings at later dates were 204/84 and 250/100 mm. Hg. One urinalysis revealed plus-one albumin and 15 to 20 white blood cells per high power field. Two later urinalyses gave completely negative findings.

Ophthalmic examination. The lids and lacrimal passages of both eyes were found to be normal, as were the conjunctiva and sclera. The corneas were clear, and sensation to cotton-wool was normal. The pupils were round, regular, and equal, but reacted sluggishly to light. The external ocular movements were normal. Convergence was poor.

The visual acuity, without correction, was 20/60 for each eye. Corrected vision was:

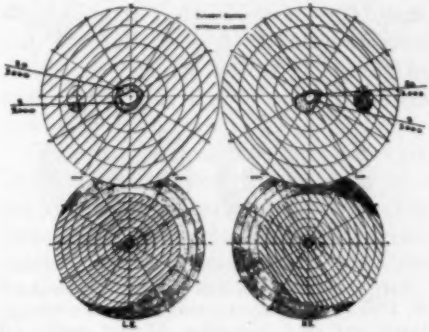

Fig. 1. (Steiner). Visual fields (5-mm. and 30-mm. white test objects, perimeter; 2-mm. and 20-mm. white, tangent screen) taken on November 13, 1947. An organic type of defect is shown.

R.E., -0.25D. sph. $\bigcirc$ -0.5D. cyl. ax. 170° = 20/30; L.E., -0.5D. sph. $\bigcirc$ -0.5D. cyl. ax. 165° = 20/20. With an add of $+2.5$D., the patient was able to read J1 with each eye.

The intraocular pressure was normal to palpation and also with the Bailliart tonometer. The readings have been repeated every few months since her first visit to the present, and all have been well within the normal limits. The media were clear.

The fundi revealed stage-one hypertensive retinopathy. No cupping or pallor of the discs was present. These examinations were repeated every few months, and the findings remained the same.

Slitlamp examination revealed a few bits of brown iris pigment on the anterior surface of the right lens, and a few dustlike opacities were seen in the anterior and posterior cor-

tex. There were no signs of active inflammation.

Visual field examination was first done on November 13, 1947 (fig. 1) and repeated every three months since that time to the present, April 26, 1950 (fig. 2). All the fields were the same. A positive response to quantitative analysis was noted when targets subtending different angles were used or when

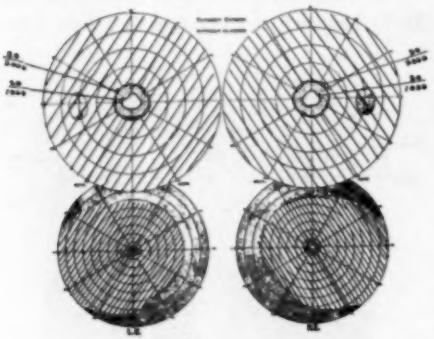

Fig. 2 (Steiner). Visual fields taken on April 26, 1950. On the tangent screen, a 20-mm. white test object was used, subtending different angles (at one and two meters), giving a quantitative response indicative of an organic lesion. (On the perimeter 5-mm. and 30-mm. white test objects were used.)

the same target was used at different distances from the patient. This served to rule out a functional loss of field.

Comment

The diagnosis of functional defects in the fields may sometimes be difficult when a psychogenic disorder is superimposed on an organic lesion such as trauma or disseminated sclerosis. The characteristic features are inconstancy in successive examinations, lack of response to quantitative analysis when targets subtending different angles register similar fields on the screen and perimeter, variability with suggestion, and, finally, the frequent presence of tubular fields, which, even when very contracted, give rise to no difficulty in orientation.

Greatly contracted fields occur in bilateral homonymous hemianopia, with sparing of the maculas, in occlusion of the central retinal artery in the presence of a macular cilioretinal artery and, rarely, in certain cases of optic-nerve atrophy. As Duke-Elder[2] states, "With the exception of bilateral homonymous hemianopia with macular sparing, bilateral concentric contraction of the fields to a marked degree with the preservation of normal central vision in the presence of normal fundi is almost certainly functional in origin."

I believe the case just reported to be one of bilateral homonymous hemianopia with sparing of the maculas, due to occlusion of the posterior calcarine arteries. The fundus findings over a period of two and one-half years rule out retinitis pigmentosa with or without pigment, as well as occlusion of the central retinal artery. Late chronic glaucoma simplex is ruled out on the basis of a consistently normal intraocular pressure, normal optic discs, and the concentrically contracted fields which were nonprogressive or recessive. As mentioned previously, functional loss of field was ruled out on the repeated organic-type of visual field findings. Also, it seems unlikely that a functional loss of field could be maintained for a period of two and one-half years.

It is fully realized that the exact anatomic diagnosis in this case can be made only by postmortem examination. On the basis of previous reports of cases in which postmortem studies were carried out (Bramwell, Bolton, and Robinson[1]), it is believed that the diagnosis of bilateral occlusion of the posterior calcarine arteries is justified.

Greens' Eye Hospital.

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BILATERAL EXOPHTHALMOS IN THE NEWBORN*

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Bilateral exophthalmos in the newborn following spontaneous delivery is a rare occurrence. Edgerton reviewed the literature and found three cases and no additional cases are found in the literature to date. Windham and Harley each reported one case of unilateral exophthalmos present in the newborn.

Fracture of the orbit with strangulation of the ophthalmic vein in the superior orbital fissure, retrobulbar hemorrhage, subperiosteal hemorrhage, and cavernous sinus injury have been considered as etiologic factors in previously reported cases. Abnormal bleeding tendency was believed to be present in one case (Veasey). Trauma produced by molding of the head in its passage through the birth canal was believed to be the primary factor in all cases.

Inflammatory disease, primary neoplasm, chloroma, and Schüller-Christian-Hand disease have not been reported as causes of exophthalmos in the newborn.

Numerous reports of exophthalmos following forceps delivery can be found in the literature. Friedenwald reported a case of luxation of the globe following forceps delivery for which a canthotomy was required before reduction was accomplished. He also reviewed the literature and found 29 similar cases.

Hoffman reported a case of spontaneous delivery in which one eye was enucleated during passage of the infant's head through the birth canal. The same mother had another spontaneous delivery three years later with repetition of this unusual accident.

REPORT OF A CASE

History. M. L. H., a boy, aged 12 days, was first seen at the Saint Philip Hospital emergency room on October 26, 1949. The mother stated she sought medical attention because the infant's eyes were bulging.

The infant was born at home at 9:30 a.m., October 14, 1949, with the assistance of a midwife following an 11-hour labor. The birth weight was nine pounds. The baby cried spontaneously and nursed well from the breasts, voided, and had normal bowel movements.

At birth the mother noticed that the child's eyes were very large and that the lids did not close over the eyes. After several days, the mother noticed no improvement and sought advice of her family physician who prescribed drops to be used in each eye every three hours.

The following day the infant was seen by the same physician and referred to Saint Philip Hospital. The mother found this inconvenient, however, and so delayed coming to the hospital until October 26, 1949, which was the 12th postpartum day.

The proptosis on the admission date was stated by the mother to be about the same or only slightly worse than at birth. There was no history of purulent discharge from either eye.

The infant was the 10th pregnancy for the mother and she stated she had had monthly prenatal care by her local physician, with regular blood-pressure determinations and urine examinations which she was told were normal. There was no history of headache

* From the Department of Ophthalmology, Medical College of Virginia, Hospital Division.

Fig. 1 (Kundert). Photograph taken on day of admission demonstrating severity of exophthalmos. (M. L. H., aged 12 days.)

or convulsions or complications at the time of delivery.

The mother stated that serologic examination of her blood specimen had been checked by her family physician and was said to be negative. There was no available maternal history of suspicious lesions and there has been no history of treatment for venereal disease. There was no history of familial disease or constitutional disease.

Physical examination revealed a temperature of 99°F. by rectum, with pulse rate 110, and respiratory rate 28 per minute. The baby was in no apparent acute distress and was well hydrated. The positive physical findings were limited to those of the eyes and orbits.

There was marked bilateral proptosis, which was more marked on the left than the right, with a relatively small amount of edema of the periorbital tissues. No marked evidence of inflammatory change, such as redness of the skin or tenderness on pressure, was present. Cervical and preauricular nodes were not palpable.

The proptosis was so extensive that the eyelids could not be made to close over the cornea of either eye without mechanical depression of the globe. Both corneas were markedly desiccated.

There was an exposure keratitis of the right cornea, but the iris could be faintly seen at the periphery. Marked chemosis of the conjunctiva was present. The left cornea was entirely covered with a thick yellowish crust and, after this was soaked with mineral oil and removed, it could be seen that the cornea was totally opaque and no iris was visible.

No retrobulbar mass was palpable. No bulging of the anterior fontanelle was present. X-ray films of the accessory sinuses and the orbit revealed no pathologic changes such as fractures, inflammatory disease, or erosion of bone.

Urinalysis was within normal limits. The erythrocyte count was 6,840,000 and the

Fig. 2 (Kundert). Same patient six weeks later. (M. L. H., aged 55 days.)

hemoglobin determination was 18 gm. The leukocyte count was 18,600 with 40-percent polymorphonuclear neutrophils, two eosinophils, two basophils, four large and 46 small lymphocytes, four immature cells of undetermined origin, and two cells unclassified (normal).

Ocular smears taken from the conjunctival sac at the time of admission were reported as showing a pure culture of Staphylococcus aureus, coagulase positive. No Gram-negative intracellular diplococci were isolated.

The serologic examination of the child's blood specimen, as well as that of the mother, was reported as negative. An examination of the peripheral blood smear from sternal puncture was done on November 1, 1949, and reported as normal. Bleeding time, clotting time, and prothrombin time (Quick method) were also reported normal.

Treatment. A five-percent sulfadiazine ointment was applied to both eyes every three hours. Silk sutures (4-0) were used to close the lids over the proptosed globes, bilaterally. Penicillin (10,000 units, every three hours) was given intramuscularly, and streptomycin (0.25 gm.) daily.

This treatment, along with the general care of the patient's diet and maintenance of normal fluid balance, resulted in a slow recession of the proptosis and return of the periorbital structures to normal by November 23, 1949 (29th hospital day).

The streptomycin and penicillin were discontinued on November 10th (14th hospital day). At this time, there was still considerable proptosis bilaterally, although it was slightly less in degree. The lid sutures sloughed on the fifth day because of pressure necrosis. Thereafter, the lids were kept closed by the use of adhesive tape. Although it was necessary to change this daily it was quite satisfactory for protection of the corneas.

The temperature curve and blood cell count remained normal through the entire hospital stay. At the time of discharge from the hospital, the left cornea was totally scarred. The right cornea, although showing some corneal haze, had cleared considerably. There was no evidence of residual proptosis. The patient was discharged on November 23, 1949 (29th hospital day), and instructions were given the mother to instill five-percent sulfadiazine and one-percent atropine in both eyes three times daily.

As of January 3, 1950, the left cornea, which consists of a large vascularized leukoma with no transparent tissue present, apparently shows irreversible changes. The child responds to light stimulus directed to the right eye and, although there is a slight diffuse corneal haze, the fundus is clearly visualized and the optic disc appears normal. There is no evidence of proptosis in either eye.

Comment

The absolute diagnosis of exophthalmos in infants as being secondary to birth trauma is a difficult one without exploration or postmortem examination. However, since no evidence of inflammatory disease, primary neoplasm, blood dyscrasia, or lipodystrophy could be found in this case, and since resolution was slow but complete and apparently unaltered by treatment, it is believed a presumptive diagnosis of bilateral exophthalmos secondary to birth trauma vascular injury can be made.

1200 East Broad Street (19).

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BILATERAL CIRCUMLIMBAL ULCERS FROM MALIGNANT DIPHTHERIA

E. H. COACHMAN, M.D.
Muskogee, Oklahoma

History. E. D. W., a Negro, aged 73 years, a retired farmer, reported on January 12, 1950, with the chief complaint of "sore eyes." For six to eight months, he had had discharge at intervals and had tried various

Fig. 1 (Coachman). Appearance of the left eye before treatment.

home remedies, such as potato and beef poultices, and all the remedies the neighbors had suggested.

Eye examination. Vision was: R.E., hand motions at six feet; L.E., hand motions at four feet. The corneas of both eyes showed a limbal ulceration, two to three mm. in width, almost surrounding the corneas. Multiple craters spotted the ulcerated area which was one to two mm. in diameter. The central corneal epithelium, which appeared like an island surrounded by the excavated ulcerous area, was so cloudy that only the contracted pupil and the color of the iris could be seen in each eye even on corneal microscopic examination.

Physical examination. The patient's temperature was 99°F.; blood pressure, 124/78; pulse, 78. Blood Wassermann and undulant agglutination tests and urinalysis were negative.

Bacteriologic study. A smear from each eye on January 12, 1950, showed many pus cells and a few diphtheria bacilli. Culture showed a heavy growth of B. diphtheria. A white guinea pig was inoculated in the abdomen with a washing from the culture. In 48 hours, there was a slight necrosis with sloughing of skin. The findings were those of a virulent type of diphtheria.

Swabs from the eye were washed in saline and used to inoculate a young guinea pig (January 12, 1950); eight weeks later, the pig had gained 200 gm. in weight and showed no signs of tuberculosis.

Treatment. The patient was inoculated with 40,000 units of diphtheria antitoxin intramuscularly, and a total of 10,000 units of diphtheria antitoxin was placed one drop in each eye every hour together with baciguent (500 units per gm.) and five-percent sulfathiazole, 0.5-percent pontocaine (as needed for pain), and one-percent atropine four times daily.

Outcome. On release from the hospital one week later, the patient could see well enough to make the 150-mile trip home by himself.

Comment. Although there were children in the home where this patient lived, no cases of diphtheria had occurred. It is of interest to note that a virulent type of diphtheria can manifest itself in a patient, aged 73 years, and can select such a rare site as the cornea. Neither nose, throat, nor ears showed a membrane or evidence of infection with the organism.

Manhattan Building.

PLEXIFORM NEURINOMA OF THE LEFT SUPRAORBITAL REGION*

HENRY F. JACOBIUS, M.D.
AND
MORRISON LEUBARG, M.D.
New York

An eight-year-old Puerto Rican boy had had a mass in the left supraorbital region since birth. This mass had become progressively larger. Six months before the first hospital admission, the mother noticed that the left upper eyelid was beginning to droop. There had never been any pain. With these exceptions, the past history was negative.

Examination at the time of admission to the Metropolitan Hospital, June 12, 1949, revealed a soft cystic, freely movable mass in the left supraorbital region. The mass pushed down the left upper lid, but there was no paralysis of the levator muscle. Vision was: O.D., finger counting at 20 feet; O.S., finger counting at one foot.

The pupils were round and equal and reacted to light and accommodation. Ocular motility was normal. The media were clear and the fundi normal.

X-ray studies of the skull and chest were negative but those of the orbits showed a rounded bony defect on the left with absence of the greater and lesser sphenoid wings. The left orbit appeared to be somewhat larger.

Blood and urine analyses were all within normal range.

The preoperative diagnoses offered by the departments of pediatrics, ophthalmology, and neurology varied from mucocele, hemangioma, and dermoid cyst to lipoma.

Operation. On June 29, 1949, under general anesthesia, a hockey-stick incision was made over the left frontal region, and a mass the size of a small orange was found.

Dissection was continued until the periosteum was reached. The mass was excised, the skin was closed, and the operation completed. The postoperative course was uneventful and, in one week, the child was discharged to the out-patient service.

Pathologic report. The specimen consisted of an irregular strand of tissue measuring five cm. in length. On section, the tissue was firm and elastic. It was fixed in formalin. Microscopic examination showed bundles of nerve tissue separated by firm connective tissue. The diagnosis was plexiform neurinoma.

Course. The child was observed frequently in the clinic, and there was no progression of the mass until September 30, 1949, when it reappeared. It grew rapidly and, in two weeks, was again the size of a small orange. The child was readmitted to the hospital.

Second operation. On November 14, 1949, under general anesthesia, a skin incision was made in the hairline, and a mass was found which followed down to the orbital rim. When orbital fat appeared, the dissection was stopped and the mass removed. The postoperative course again was uneventful, and the child was discharged to the outpatient service in a week.

The second pathologic report was plexiform neurinoma.

COMMENT

Although plexiform neurinoma is found frequently in other regions, a search of the literature does not reveal a report of this type of tumor being located in the supraorbital region.

Consequently, the location, as well as the lack of pain and the rapidity of recurrence, makes this case of more than passing interest.

After the second operation, the child was transferred to the neurosurgical service for continued observation. At this writing, the mass is beginning to reappear. It is planned to prepare a bone flap and remove the tumor from the orbit.

300 West 23rd Street (11).
300 West End Avenue (24).

* From the Services of Pediatrics and Ophthalmology, Metropolitan Hospital.

A GUARD LENS FOR THE REFRACTOR

RICHARD HAMILTON WHITTEN, M.D.
Fresno, California

The employment of the multiple lens battery device in refraction has become almost universal despite certain disadvantages which limit its usefulness.

Among these is the difficulty in cleaning the exposed parts after contamination. In

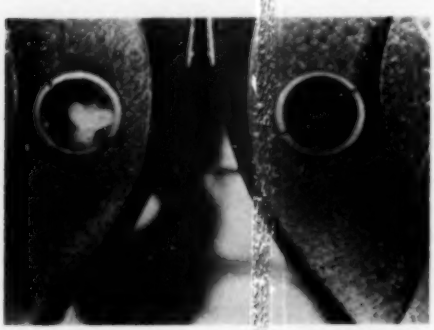

Fig. 1 (Whitten). A guard lens for the refractor.

old models with eyecups, paper covers for these were available but expensive and cumbersome, and protected but a small area. Disposable masks for the rear plate of the newer models were even less desirable for similar reasons, and found little favor in practice.

Examination of the dissembled instrument during cleaning revealed lash marks on the posterior surface of the anterior battery of lenses and its carrier, pointing the need for protecting all internal parts, or complete dissembly and cleansing after each contamination. Recent articles on the ophthalmologist's office as a source of infection in spread of ocular disease emphasize the need for protection of the patient at all stages of the examination.

In an attempt to increase the use of the refractor over the slower but more easily cleaned trial frame with loose lenses, the following simple device* was installed on the refractors in our office and has proved successful.

The aperture in the rear face plate of the refractor was threaded and a lens mounted in an insert ring was screwed in place, making a removable but dust and waterproof seal. This prevents contamination of the lenses and internal parts of the instrument and aids in keeping them dust free.

Because of the space limitations, use of a flat lens was required. To prevent reflections which would interfere with skiascopy this lens was treated with antireflection coating.

After known contamination, and periodically, the instrument may be cleansed readily by simply wiping the whole rear face plate including the protective glass with any noncorrosive antiseptic. Alcohol (70 percent) and zephiran (1:1,000) have proved safe in our hands.

2900 Fresno Street Building.

* This device was developed by the Parsons Optical Laboratories, 518 Powell Street, San Francisco, California, with the technical aid of Mr. A. H. Parsons. His help is acknowledged with appreciation.

CHOROIDITIS PROLIFERANS*

DAWSON A. MILLS, COMDR. (MC), U.S.N.
Newport, Rhode Island

Little note has been made of the occasional proliferative reaction which may occur in the choroid after trauma or inflammation. Fuchs[1] was probably the first to call attention to this type of choroidal response which he, in 1943, termed choroiditis proliferans. He noted that it may follow local trauma or exudative lesions. Later, in a second account of the disease, he[2] presented six cases and offered a mechanism for the pathogenesis of the lesion. Another reference to the disease appeared in 1948 when Yen[3] reported two cases, both of which he attributed to an

* From the U. S. Naval Hospital. The opinions and views set forth in this article are those of the writer and are not to be construed as reflecting the policies of the Navy Department.

exudative (inflammatory) detachment of the retina.

Tower,[4] in discussing traumatic responses in the choroid, made no mention of proliferative lesions.

Report of a case

History. A 23-year-old white man was seen for the first time on August 19, 1948. He complained of diminished vision in the right eye. This loss had been gradual, extending over a two-year period. In recent months a metamorphopsia had been observed with the right eye. A history of two definite episodes of trauma was elicited.

In April, 1944, the patient was involved in an automobile accident at which time he sustained a mild concussion and a deep laceration on the right side of the forehead. No note was made of any ocular involvement.

In October, 1944, he was struck over the right eye by a torpedo rudder while at work. This apparently caused some transient disturbance of vision but no record was made of the vision. This disturbance cleared in about one week.

The remainder of the history was noncontributory.

Fundus examination of the right eye revealed a number of white, striate lines, extending peripherally on each side of the disc. The retinal vessels passed over these lesions. Study with a binocular ophthalmoscope revealed that they were all subretinal. They appeared to be fibrotic organization rather than choroidal tears. Although crescentic in shape, they presented the convexity toward the disc rather than away from the disc as is usual in tears. Toward the peripheral portions in the lower hemisphere, there was a retinal detachment of up to 12 diopters, extending from the 3- to the 8-o'clock positions, which showed proliferative changes and what appeared to be two small gliosed holes at the 7-o'clock position, well out in the periphery.

The deeper red reflex was clearly seen through these holes, but the fleecy, proliferating tissue about them gave the observer the impression of looking through a veil. The disc and vascular tree appeared normal. The macula was of fair form but seemed close enough to one of the lines that its involvement was assumed.

Tension was: 23 mm. Hg (Schiøtz). Except for faint, posterior, striate opacities of the lens, the media were clear. Uncorrected vision was from 4/20 to 6/20.

The left eye was normal except for simple myopia of 0.50 diopter.

Discussion

No histologic study of choroiditis proliferans is reported. However, the lesion appears to be wholly in the choroid, leaving the retina uninvolved. The most typical aspect is the shiny, tendonlike strands which at first resemble choroidal tears. Close examination will reveal that each strand is not a tear but rather a fibrous tissue proliferation occurring subretinally.

Fuchs[1] believed that the proliferation of fibrous tissue represented a mild inflammatory reaction with fibrin response instead of leukocytic response, following either a traumatic or serous detachment of retina. In another discussion he stated that an exudative choroiditis precedes the change. The choroiditis in turn may be initiated by trauma as with traumatic detachment.

The fact that several reported cases have followed a diagnosis of Harada's disease would seem to substantiate this. Whatever the early change, it appears that the fibrous tissue is the result of organized exudate, the fibrosis and exudation jointly resulting in the final picture of strands, gliosis, and retinal detachment.

It is difficult to postulate any effective treatment, since surgical trauma might only serve to stimulate further fibrous changes. In the case herein presented, no treatment at all was undertaken. A close observation for over one year failed to reveal any change or advancement.

SUMMARY

A proliferative type of response may occur in the choroid following trauma or exudation. This occasionally leads to what is now recognized as an entity, choroiditis proliferans. One such case is presented.

U. S. Naval Hospital.

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A NEW MUSCLE FORCEPS*

CONRAD BERENS, M.D.
New York

A new muscle forceps† for surgery on the ocular muscles is described which usually eliminates the necessity for using a tenotomy hook and which is applied at right angles to the muscle.

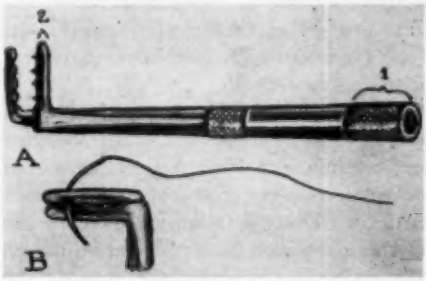

Fig. 1 (Berens). A new muscle forceps. (A-1) Knurled head. (A-2) Upper blade of forceps with four pins. (B) Note jaws of forceps with holes for the passage of needle.

The muscle forceps has an overall length of 82 mm. and has a knurled head which, when turned, presses the lower blade against the muscle and the stationary upper blade. The blades of the muscle forceps are 10 mm. in length and the upper blade is armed with four pins to prevent slipping of the muscles (fig. 1—A).

When the blades are closed, catgut, silk, or nylon sutures on atraumatic needles may be passed directly through holes drilled between the blades of the forceps (fig. 1—B). This permits the cut end of the muscle to be pressed into direct contact with the edge of the incised muscle or tendon stump.

The lower blade is constructed to pass directly under the muscle without first introducing a tenotomy hook (fig. 2).

The muscle forceps is applied at right angles to the muscle and therefore is less awkward to use than conventional muscle forceps.

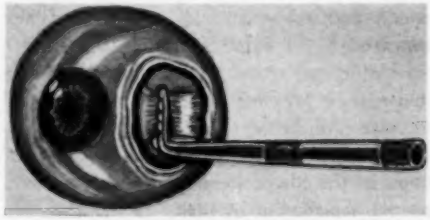

Fig. 2 (Berens). The lower blade of the forceps has been passed under the muscle at the attachment to the globe without using a tenotomy hook.

* Aided by a grant from The Ophthalmological Foundation, Inc.

† Made by E. B. Meyrowitz and Company, New York.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

PITTSBURGH OPHTHALMOLOGICAL SOCIETY

May 22, 1950

DR. J. S. PLUMER, *presiding*

MALIGNANCIES OF PERIPAPILLARY AND MACULAR REGIONS

DR. WILFRED E. FRY of Philadelphia, guest speaker, stated that in malignancies of these areas, diagnosis is difficult because transillumination is difficult or impossible and lack of other diagnostic procedures bases the handling of the case on the appearance and history of the lesion. He presented three illustrative case histories.

Of the malignancies to be considered, malignant melanoma, metastatic carcinoma, retinoblastoma, and hemangio-endothelioma are the important ones to be considered.

Of nonmalignant conditions, the commonest are disciform degeneration of the macula, senile macular degeneration, hole in the macula, toxoplasmosis, coloboma, cystoid degeneration of the macula, choroiditis, and central serous retinopathy.

The differential diagnosis between the benign and malignant lesions was then briefly summarized, with emphasis on the fact that diagnosis is often difficult and the appearance of the lesions confusing.

Discussion. Dr. Larimore asked: "What is the slowest rate of growth in your experience, over how long a period of time?"

Dr. Fry replied that the best way to answer is to point to the case reviewed in which there was a tumor at the margin of the disc; this case developed over a period of two years; others develop in a few months. He mentioned that the Huggins test was not used; in the future this test might prove helpful.

Dr. Billings then asked Dr. Fry if he could draw any conclusions as to frequency or severity of metastases of the anterior sections compared to the posterior sections of the globe.

Dr. Fry said that most malignancies are of spindle-cell types which metastasize much less frequently; spindle-cell type A behaves almost like a fibroma; the mixed tumor cell metastasizes much more easily, so it depends upon the type of tumor cell rather than the position in the eye.

Dr. Weisser asked whether repeated measurements of the size of the scotoma gave any lead as to differential diagnosis, particularly in reference to speed of enlargement.

Dr. Fry answered that inflammatory lesions cause scotomas to enlarge in a matter of days; malignancy in a matter of weeks; degeneration in a matter of weeks or months or years. The scotoma would seem, therefore, to give a lead.

C. William Weisser,
Recorder.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

May 1, 1950

DR. SIDNEY A. FOX, *president*

ANISOCORIA

DR. OTTO LOWENSTEIN discussed the interpretation and practical significance of anisocoria during the instruction period.

CHRONIC UVEITIS AND CORTISONE THERAPY

DR. FREDERICK THEODORE reported a case of severe bilateral uveitis. The patient had had an iridencleisis operation performed in each eye in the summer of 1949. The eyes were perfectly normal thereafter for three months. In December, 1949, severe chronic

uveitis occurred. The patient was hospitalized and given intensive treatment, including the use of intravenous typhoid vaccine. He was discharged after three weeks somewhat improved but still with an active uveitis.

In February, 1950, he was readmitted to the hospital because his condition had become so serious that it was decided to try cortisone therapy. Before treatment started, vision was 5/200 in the right eye and 20/100 in the left eye. No fundus details could be seen due to the cloudiness of the media, especially in the right eye.

Cortisone was given in four divided doses daily at the rate of 150 mg. a day. A total of 1.5 gm. was used during the entire two weeks that he was under treatment.

Within three days of the onset of this treatment, both subjective and objective evidence of improvement occurred. At the time of his discharge from the hospital, two weeks later, his vision was 20/60 in the right eye, and 20/40 in the left eye, despite some old corneal opacities present since childhood. In addition, the media cleared to such an extent that fundus details could be made out fairly well.

For about three weeks after this, the patient did quite well. After that, however, it became evident that his condition was slowly deteriorating and, when last seen, his vision had diminished to 20/70 in each eye and the media again had become cloudy.

The improvement which occurred in this case was quite striking. That cortisone was responsible for this improvement seems definitely established by the unsatisfactory condition of the patient previous to the use of the drug and a change for the worse after the therapy was stopped. It is suggested that for beneficial effects, cortisone should be kept at the optimum level by small maintenance doses, if at all possible, in those cases in which regression may jeopardize the eye. Cortisone appears to be only palliative, not curative, in chronic uveitis.

Ophthalmologists will speculate as to whether, perhaps, one of the reasons foreign-protein therapy and hyperthermia are effective in ocular inflammation is that they stimulate the increased formation of cortisone or related substances by the adrenal cortex either directly or through the anterior pituitary gland.

Horner's syndrome

Dr. Norman S. Jaffe said that the syndrome of Horner includes the following:

1. Miosis: This is the most constant feature of the syndrome. The size of the pupil varies with the site of the lesion and the degree of sensitization (denervation phenomenon).

2. Ptosis. In lesions of the first sympathetic neuron, ptosis is often absent. This may be due to the fact that the descending sympathetic fibers are more freely dispersed or that the fibers for miosis are most sensitive.

3. Enophthalmos. This does not occur in humans because of the absence of the smooth orbital muscle present in animals.

4. Anhydrosis. This is not present if the lesion is distal to the bifurcation of the common carotid artery since the sweat fibers traverse the external carotid artery while those for miosis accompany the internal carotid.

5. Ocular hypotony. There is an immediate drop in tension following cervical sympathectomy in animals. The tension returns to normal in about two days.

6. Transitory rise in face temperature.

7. Depigmentation of the iris.

8. Other occasionally associated signs—alteration in the secretion of tears, facial hemiatrophy, cataract formation, and increase in accommodative amplitude.

Lesions causing Horner's syndrome may be localized by two methods: (1) Tests to determine the level involved and (2) by an evaluation of signs and symptoms attributed to involvement of neighboring structures. The most practical test for sympathetic integrity is the cocaine test. The pupil does not dilate when the sympathetics are interrupted. Epinephrine causes no exaggerated response when the lesion is postganglionic (denerva-

tion phenomenon). The reaction is less marked if the lesion is in the second neuron and absent if in the first.

The miotic pupil dilates poorly with homatropine due to the absence of sympathetic tonus. In central lesions which cause simultaneous involvement of the parasympathetics (third nerve) and the sympathetics, the pupil dilates somewhat, and it is difficult to tell that the sympathetics have been damaged. The homatropine test is of no value here.

Contrary to some previous reports, it was shown that a cervical sympathetic lesion causes a marked diminution in the response of the pupil to stimuli such as a loud noise, a pin prick, and so forth (psychosensory pupillary reflex). In cats and monkeys, the reaction decreases 80 percent. The residual response is probably due to central third-nerve inhibition.

Richter's method of mapping out sympathetically denervated areas by demonstrating an increase in the resistance of the skin to an electric current is valuable. It is of no use if the lesion is beyond the bifurcation of the common carotid artery.

Horner's syndrome is usually associated with other signs and symptoms which aid in localization. There are specific syndromes represented in each of the three sympathetic neurons.

Dr. Jaffe presented four cases, in which the tests he described were done. The cases were: paratrigeminal syndrome (carotid aneurysm in the neighborhood of the gasserian ganglion), Wallenberg's syndrome, sternal adenoma of the thyroid, and luetic aneurysm of the aorta.

Salzmann's nodular corneal dystrophy

Dr. Dewey Katz said that, in 1925, Salzmann reported on 23 cases of a nodular type of corneal lesion which differed from the known nodular corneal lesions. Because of this, he considered them as a new clinical entity. Salzmann classified these cases as nodular corneal dystrophies.

Since then, cases of nodular corneal dystrophy of the Salzmann type have been described by Katz, Laedekarl, Lugli, and others. The characteristic feature of Salzmann's nodular corneal dystrophy is the marked prominence of the nodules above the surface of the cornea. The nodules are of various sizes and shapes, with some tendency to fuse when several are present. They have varied in number from one to eight and frequently are bluish-white in color.

Another characteristic feature of Salzmann's nodular corneal dystrophy is that, in the majority of instances, the involved eyes show evidence of repeated attacks of phlyctenular keratitis. The frequency with which Salzmann's nodular corneal dystrophy affects the female sex is striking; of 55 known cases, 65 percent were in females. There has been no familial tendency.

At the time of the various reports approximately 20 percent of the cases showed bilateral involvement and 80 percent, unilateral involvement. The ages of the patients range from 12 to 72 years. The visual acuity of the affected eyes was markedly reduced when the central zone of the cornea became involved.

A number of dystrophic nodules have been removed and studied histopathologically. In general, the pathologic changes were constant for each nodule but varied markedly from nodule to nodule. This was the finding in three nodules removed from the same cornea at approximately the same time by Dr. Katz. There is a marked difference in the histopathologic findings in the nodules removed by others. It is apparent that changes in this disease could be described only by studying the stages in the development of the nodule.

Medical treatment has been of no avail. To date complete surgical removal of the dystrophic areas has offered the best possibility of visual improvement in those cases in which the visual acuity has been sufficiently reduced to warrant a surgical procedure. Dr. Katz has no experience with the use of various forms of radiation therapy and cannot state if such would be beneficial.

Bernard Kronenberg,
Recording Secretary.

COLORADO OPHTHALMOLOGICAL SOCIETY

April 15, 1950

Dr. Leonard Swigert, *president*

Nevus flammeus

Dr. Fritz Nelson, of Colorado Springs, presented a case of nevus flammeus in the right eye and surrounding skin of a girl aged two and one-half years. The parents stated that the right eye had been bigger than the left since birth. The right cornea measured 13.5 mm.; the left, 10.5 mm. The right pupil was larger than the left.

Tension was R.E., 27 mm. Hg; L.E., 18 mm. Hg (Schiøtz). After dilation with paredrine and cocaine each optic nerve was found to be normal. The right eye required a −6.0D. sph., the left eye was emmetropic.

One-percent pilocarpine did not affect the tension. With two-percent pilocarpine, tension was: R.E., 32 mm. Hg; L.E., 18 mm. Hg. Dr. Nelson stated it was his habit to treat such cases conservatively if the tension remained under 35 mm. Hg and the optic nerve remained normal. Otherwise he felt surgery to be indicated.

Dr. John Long suggested cautious use of cyclodiathermy if surgery is attempted. Dr. Edward Swets stated that, in his experience, convulsive seizures are common in such cases.

Orbital fracture

Dr. William Droegemueller, of Greeley, presented a 26-year-old man whose left eye had been blind since an auto accident two weeks previously. There was no other neurologic change except loss of sensation over the maxillary division of the left fifth nerve.

X-ray films showed a fracture of the floor of the orbit and the zygomatic process of the maxilla.

The left pupil had recently been smaller than the right, probably due to irritation of the sympathetics on that side from pressure along the optic nerve. No pathologic change was noted in either fundus.

Dr. Droegemueller felt that exploration of the orbit to relieve pressure was not advisable. Dr. John Egan cited a case of orbital fracture in which proptosis, ecchymosis, and reduced vision developed. These were relieved by exploration of the orbit.

It was the consensus of those who had examined this patient that, since similar cases have cleared spontaneously, conservative treatment was indicated.

Rupture of lens capsule

Dr. Edward Swets presented a 30-year-old man who had been struck in the left eye on March 26, 1950, while attempting to pull a dead limb from a tree. Examination that day showed corneal abrasion, inferior iridodialysis, and vitreous hemorrhage obscuring the fundus reflex. The hemorrhage slowly cleared. On April 4th, iridodenesis appeared and fibrin or lens cortex was seen in the pupil. At the date of presentation it appeared that the lens capsule had been ruptured and the nucleus dislocated posteriorly.

Glaucoma

Dr. Swets also presented a 50-year-old woman whose only complaint was rainbows about lights. This had started in September, 1946. Both eyes were affected. The patient gave a history of 18 cases of glaucoma on the paternal side, including her father, an uncle, and a grandmother. She had five children none of whom had eye trouble.

Schiøtz tension was: R.E., 33 mm. Hg; L.E., 38 mm. Hg. The optic nerves were normal. Vision was 20/15 each eye. Since miotics were not completely adequate, an iridencleisis was performed on each eye in the summer of 1949; in addition, two cyclodialyses were necessary to control the tension in the left eye.

At the date of presentation vision was: R.E., 20/15; L.E., 20/20. The fields were normal.

Dr. George Filmer pointed out that in making conjunctival flaps for filtering operations, the bleb is most efficient when the conjunctiva has been least traumatized.

Retinitis pigmentosa

Dr. Joseph Kafka presented two cases of retinitis pigmentosa in sisters, aged 33 and 28 years, whose parents were first cousins. There was a history of eye trouble in the maternal grandfather who was blind 12 years before his death. His vision had become progressively poorer for some time before his blindness.

The elder of these patients had posterior central lens opacities. This patient had one child; her sister, two. There is no ocular defect in these children.

Dr. Kafka raised the question of treatment of the cataracts (best corrected vision 20/50 and 20/80) and of the responsibility of the ophthalmologist in giving eugenic information and advice.

Dr. M. Shwayder said that cataract surgery in such cases often gives poor results. Dr. G. Stine advised removing the lens only as a last resort.

Dr. F. Nelson said that it should be borne in mind that the chances of offspring getting this disease are not great and that with the disease the individual can, nevertheless, lead a full life. Dr. J. Egan voiced the opinion of most when he suggested the facts be explained to the parents and the decision left to them.

Cataract and atopic dermatitis

Dr. M. Rider, resident in ophthalmology at the University of Colorado Medical Center, presented a 24-year-old college student with cataract and atopic dermatitis.

This young man was first seen at the eye clinic in October, 1948, complaining of blurred vision. Vision then was: R.E. 20/25; L.E., 20/20. Each lens showed punctate and fibrillary opacities under the anterior and posterior capsules. There were tiny "feathery knobs" on the Y sutures.

This patient had had infantile eczema until he was three years of age, asthma from seven to 14 years of age, and atopic dermatitis of the scalp, face, and neck, antecubital and popliteal fossas since the age of 12 years, with remission in attacks of asthma. His symptoms are minimal in Arizona and Colorado.

There are many cases of allergy on the mother's side of the family, none on the father's side. He has two siblings both of whom have asthma. When presented at this meeting, vision was: R.E., 20/25; L.E., 20/20. The condition of the lenses and of the dermatitis was the same with no exacerbations of dermatitis in the preceding 18 months.

Dr. Vanderhoof cited several similar cases in which cataract surgery had given poor results. In the opinion of Dr. William Bane this is because, in such cases, ectodermal tissue is the principal focus of the disease.

After dinner there was held the annual election of officers of the society. Then Dr. George A. Filmer of Denver gave an enlightening paper on "Illumination from the standpoint of the ophthalmologist."

Thomas M. Van Bergen,
Recorder.

OPHTHALMOLOGICAL SOCIETY OF MADRID

April 28, 1950

Keratoplasty for keratoconus

Dr. F. Galindez Iglesias said that the treatment of keratoconus can be medical, optical, and surgical.

The medical treatment consists of general measures to improve the health of the patient; local measures such as pilocarpine to cause contraction of the pupil; and a pressure bandage at night to prevent increase of the conus. These measures are generally ineffective.

In the early stages good results are ob-

tained with lenses which correct the myopia and astigmatism, but later these aids become useless. Stenopaic spectacles help in reading. Contact lenses give good vision, although in advanced cases the apex of the cone becomes opaque and limits the utilization of contact lenses. In addition contact lenses are frequently uncomfortable and produce corneal edema and turbidity of the buffer solution.

The surgical treatment comprises three techniques: (1) Intraocular operations—paracentesis, extraction of the crystalline lens, displacement of the pupil, producing a fistula—none of which act on the corneal deformity; (2) excision of the vertex of the cone and suturing the wound (this produces many complications); (3) flattening the vertex of the cone by producing a cicatrix by means of cauterization with silver nitrate, galvanocautery, and even diathermy. These measures produce a cicatrix which causes disturbances of vision and is somewhat disfiguring. In reality most of the techniques just mentioned, instead of improving vision, produce a more or less intense ocular disturbance.

One must keep in mind that a satisfactory treatment of keratoconus must adhere to these two principles: (1) If poor vision is due entirely to the corneal deformity, the surgical means must limit themselves to the cornea; (2) in order to obtain the best possible vision the whole corneal protrusion must be removed and replaced by corneal tissue of normal curvature and thickness and the pupillary zone must remain free from a scar.

The only surgical procedure which satisfies these two conditions is the partial, penetrating keratoplasty by means of which it is possible to get permanent improvement in 75 to 80 percent of the cases, as has been shown by Castroviejo since he developed this technique in 1936. It is the most logical treatment in advanced keratoconus where vision cannot be improved with ordinary lenses or contact lenses.

Before the operation one must study with the biomicroscope the thickness of the cornea and the extension of the keratoconus, since the size and location of the transplant depends on the extent and location of the conus.

The transplant must substitute all or the greater part of the affected cornea. Otherwise the deformity may increase. The smallest size transplant which can be used in keratoplasty is about six mm., unless the conus is very small. It should be placed in the center of the cornea so that the center of the transplant is opposite the pupil, although at times it is necessary to displace it according to the more or less eccentric position of the apex of the cone.

Dr. Iglesias reported a patient, M. M., aged 17 years, with bilateral keratoconus very much advanced in the right eye. With this eye he could only see large objects, due partly to the astigmatism and the myopia and partly to an opacity at the apex of the conus.

A partial penetrating keratoplasty, 6.5 mm. in diameter, was performed on March 7th, using the following technique:

One-half hour before the operation, an ampule of penumbrol was injected. Local anesthesia was obtained with five-percent cocaine, akinesia with two-percent novocain. A retrobulbar injection of four-percent novocain was given. In addition, injection of 10-percent alcohol was administered in order to assure perfect postoperative quiet and to suppress the axon reflexes from the cornea.

The pathologic part of the cornea was marked off with Castroviejo's trephine which was centered with the apex of the cone. There was continuous instillation of fluorescein to make the section more visible. A transplant of equal size was obtained from the cornea of the donor eye which was kept moist until it was placed on the patient's eye.

A keratome was used to incise the cornea; then the curved scissors of Castroviejo. The cornea of the donor was placed and eight sutures were placed from edge to edge with the needles of Grieshaber. These secured the edges firmly and allowed the patient to get up on the following day.

The operation was under mydriasis in order to avoid postoperative anterior synechias. The danger of wounding the crystalline lens is very slight if sufficient care is taken.

A binocular compression bandage was placed on the eyes and, 48 hours later, the anterior chamber was restored and the graft transparent. The postoperative course was favorable and, two weeks later, vision had progressively improved from merely seeing large bulky objects to reading with the operated eye. Distant vision, 1/6 without correction at first, is continually improving.

Melanosarcoma of the choroid

Dr. Marin Amat presented the case of a 57-year-old man who for two months had noticed a slight shadow in the right eye, and for several days had felt some pain in the back of the orbit and in the temple on the same side.

Examination of the left eye showed an extraordinary number of myelinated fibers which almost surrounded the papilla. Refraction and visual acuity were normal.

The right eye, which appeared normal, was emmetropic, with a visual acuity of 1/3 which was not improved by the stenopaic disc. Ophthalmoscopy showed the presence of a little elevation situated in the upper and outer quadrant, blackish and perfectly delineated from the overlying retina. It was uniformly adherent to this membrane near the papilla, was raised about three mm., and extended three to four papillary diameters forward. The rest of the fundus was perfectly normal.

By diaphanoscopy, the illumination of the pupil was obscured when the contact lamp was placed as far back as possible along the vertical meridian superiorly. The situation of the neoplasm at the posterior pole of the eye prevented reaching it with the lamp. All other clinical laboratory tests were negative. Based on these findings, as well as on the fact that the ocular tension was 25 mm. Hg and that, within a period of five days in which the patient was observed, there had not been the least change, Dr. Amat made a diagnosis of melanosarcoma of the choroid and proposed the immediate enucleation of the eye.

On the following day the eye was removed and pathologic examination showed the lesion to be a melanosarcoma of the choroid.

Discussion. Dr. Galindez Iglesias said that sarcoma of the choroid presents interesting problems, not the least of which is the matter of treatment. When such a neoplasm can be given a definite clinical diagnosis, we must enucleate the eye, although it may have excellent vision, in order to prevent the probable death of the patient through metastasis by the blood or lymphatics.

This does not follow, however. Three years ago I saw a woman, aged 40 years, with all the symptoms of a choroidal sarcoma—the typical ophthalmoscopic picture, positive transillumination, and so forth. Surgical intervention was immediately decided upon, with some radiotherapy before operation to prevent dissemination during the operation, and some prophylactic radiotherapy after the enucleation. The eye was sent to a reliable laboratory; the findings were negative.

We may consider that either the histologic examination was not correct, or that there was really no malignant neoplasm, but a benign tumor.

In this connection there is an interesting work by Dr. Reese (from the United States) in which he outlines a series of melanoblastomas which can give rise to melanomalike tumors. These melanoblastomas may be (a) of ectodermal origin, and give rise to precancerous melanosis and cancer of the lids and conjunctiva; (b) melanoblastomas of mesodermal origin which appear in the uvea, and from which are derived the malignant and benign chromatic melanomas (the previously mentioned case belongs to this class); and (c) melanoblastomas of neurogenic origin, derived from the cells of Schwann, nerve cells, and leptomeninges. These produce the malignant neurogenic melanomas.

Joseph I. Pascal,
Translator.

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JOURNAL SUBSCRIPTION RATES TO BE INCREASED

The Board of Directors of the Ophthalmic Publishing Company reluctantly announces a slight increase in subscription rates for the AMERICAN JOURNAL OF OPHTHALMOLOGY, effective with the October issue.

Since the establishment of the current series of the JOURNAL in 1918, the subscription price has remained at $10.00 per annum for domestic subscriptions, through the vicissitudes of wars and economic upheavals.

In the past seven years, printing costs have quadrupled and overhead expenses have increased correspondingly, due to inflationary trends and the increase in size and content of the JOURNAL.

During the same period, the circulation of the JOURNAL has doubled, and this has made it possible to maintain the subscription rate unaltered up to the present time.

A recent increase in printing and paper costs of about eight percent has precipitated a decision to increase the rates rather than reduce the size of the magazine or in any

way impair the standards being maintained by the editor-in-chief and his editorial board.

It should be emphasized that the AMERICAN JOURNAL OF OPHTHALMOLOGY is not a profit-making venture but is published as a service to the profession—a service which can be perpetuated on its present high plane only if it is possible to meet increased expenses.

The new subscription rates will be $12.00 a year for domestic, and $14.00 a year for foreign subscriptions.

William A. Mann.

FOREIGN-PROTEIN THERAPY IN OPHTHALMOLOGY

I'll rack thee with old cramps;
Fill all thy bones with aches; make thee roar,
That beasts shall tremble at thy din.
—Tempest, Act I., Scene 2.

Grey-Edwards was probably the first to administer bacterial products in the treatment of ocular disease in 1908. Since his report on the use of staphylococcic vaccine in the treatment of hypopyon ulcer, literally hundreds of compounds have been suggested for nonspecific, shock or foreign-protein therapy.

The striking therapeutic effects of the adrenocortical hormones in ocular inflammation have led many authorities to suggest that the beneficial actions which follow the "nonspecific response" are due mainly to stimulation of the adrenal cortex in a defense reaction of the body to a noxious stimulus.

It is, therefore, of interest to clarify the status of foreign-protein therapy in ophthalmic disease since, if the action is directly attributable to adrenocortical stimulation, this method of therapy should be abandoned if more potent and specific effects may be obtained by administering ACTH or cortisone.

The continued use of foreign-protein therapy in ophthalmology can be justified only if it has or causes desirable effects not related to the actions of the adrenocortical hormones.

Bennett and Beeson, in a recent comprehensive review, point out that the common denominator of all of the substances used as foreign proteins is bacterial pyrogens. Pyrogens are heat stable, complex polysaccharides formed wherever bacteria are grown. Gram-negative rods are the most potent producers. Compounds not contaminated by bacteria in any stage of their preparation do not cause fever and are of no value in eliciting the nonspecific response. Different bacteria produce different pyrogens and this variation may be the basis of the clinical popularity of certain vaccines for the treatment of specific clinical conditions.

There is little question but that bacterial pyrogens stimulate the adrenal cortex to the secretion of its characteristic steroid hormones. This stimulatory action is mediated through the pituitary gland and ACTH, but whether it occurs because of a reduced titer of the cortical hormone in the body fluids or because of a release of epinephrine is not known.

At any rate administration of bacterial pyrogens causes depletion of the adrenal ascorbic acid, depletion of sudanophilic substance, decrease in concentration of cholesterol, and increase in glandular weight—all evidences of adrenal stimulation.

The quantity of cortical hormone released is proportionate to the degree of malaise and fever which in turn is proportionate to the dosage of the bacterial pyrogen and the activity of the reticulo-endothelial system in removing it from the circulation.

Adrenalectomized animals are extremely sensitive to the noxious effects of bacterial pyrogens and are killed by doses which are much too small to have any action in the intact animal.

Cortisone induces an atrophy and depression of function in the adrenal cortex with transient effects similar to those of hypoadrenalism. Sprague points out that it is

possible that adrenal cortical function in a patient who had recently been receiving cortisone might therefore be inadequate under conditions of stress, such as trauma, fever, or surgical operation.

In such a condition of hypoadrenalism the administration of bacterial pyrogens is extremely perilous and is definitely contraindicated. The withdrawal of ACTH is not followed by as marked adrenal depression, and bacterial pyrogens may be administered either concurrently or following the cessation of therapy.

Pyrogens have several reactions which are not related either to fever production or adrenal stimulation. For most part these actions are entirely divorced from the eye but their very occurrence suggests the possibility of similar ocular effects. The occasional prompt clinical response to the administration of a bacterial vaccine when ACTH or cortisone have been ineffective may be on this basis.

The scope of usefulness of bacterial pyrogens in ophthalmic disease has been exceedingly restricted by the brilliant results with ACTH and cortisone. However, pyrogens have the advantages of familiarity, inexpensiveness, predictability, and relative freedom from dangerous side-effects when used in reasonable dosage and not as a substitute for a fever cabinet. The recent release of an almost completely purified bacterial pyrogen and the increasing interest in the mode of action promises interesting findings from the laboratory and the clinic within a short time.

Frank W. Newell.

BOWMAN MEMORIAL FUND

The sum of £574, donated by American Ophthalmologists to the Bowman Memorial Fund, has been forwarded to the Venerable C. E. Lambert, Archdeacon of Hampstead, Rector of Saint James' Picadilly, with this accompanying letter:

The Venerable C. E. Lambert
Archdeacon of Hampstead
Rector of St. James' Picadilly
London, England

My dear Archdeacon:

It gives me great pleasure as editor of the AMERICAN JOURNAL OF OPHTHALMOLOGY to present to you the sum of £574 for use by you in helping to restore the famous and beautiful church of St. James' Picadilly.

I do this as agent for the many ophthalmologists of the United States who have freely and happily contributed this sum in grateful memory of Sir William Bowman, a worshipper in your church.

American ophthalmology appreciates its debt to the good works of Sir William Bowman and wishes you to accept this token payment of it, with the desire that you add it to the general fund for the restoration of your church.

It would please us, Sir, if you could arrange to place a small and modest bronze plate near the memorial tablet of Sir William pointing out that "A donation to aid in the restoration of this church has been made by ophthalmologists of the United States in appreciation of the services of Sir William Bowman to their science."

The AMERICAN JOURNAL OF OPHTHALMOLOGY will take pleasure in assuming the expense of the preparation and placement of the bronze plaque.

(Signed) Derrick Vail, M.D.

CORRESPONDENCE

USE OF COATED LENSES IN OPHTHALMOSCOPY

Editor,

American Journal of Ophthalmology:

Antireflection coating was used extensively on optical instruments and camera lenses in World War II. This coating increases the transmission of light and decreases reflection. The earlier work of Den-

nis Taylor in observing this phenomenon was reported by Graham.*

The present process is the coating of the lens with a 0.000004-inch (0.0001-mm.) thickness of a hard, inert mineral salt, usually magnesium fluoride, evaporated at high temperature and fused to the surface of the glass under a vacuum of 1/10,000,000 atmosphere. The molecular vapor thus produced condenses on the optical element to form a fairly durable and transparent layer. The coating may be applied to crown or flint glass. On crown glass there is a six-percent increase in transmission of light, which has made the process useful for camera lenses. At the same time, intensity of light reflected by a treated lens is reduced by about 60 percent.

The satisfaction in using coated lenses in retinoscopy, first reported in 1948,† has continued. Retinoscopy through coated lenses makes the shadow much clearer and sharper. The reversal point is more easily seen. There is absence of annoying side images; also there is an apparent effect of no lenses. This prompted me to have the lenses in an ophthalmoscope coated.

An ordinary Bausch & Lomb ophthalmoscope was coated and, although the results are entirely subjective, it seems to be a valuable diagnostic aid. With a coated ophthalmoscope, light is increased and artefacts or mirror reflections are reduced to a minimum. Vail‡ states that a coated ophthalmoscope would undoubtly be an asset, but that there would be difficulty in replacing the lenses satisfactorily. This problem was presented to The Pacific Products Company of Pasadena who constructed a jig which prevented the displacement of the lenses during the coating process.

(Signed) George S. Zugsmith,
San Pedro, California.

* Graham, R.: Reduction of reflection. Arch. Ophth., **36**:315-320 (Sept.) 1946.

† Zugsmith, G. S.: Use of coated lenses in retinoscopy. Arch. Ophth., **39**:383-385 (Mar.) 1948.

‡ Vail, D.: Personal communication.

Ophthalmic literature needed

Editor,
American Journal of Ophthalmology:

American ophthalmologists on various missions in Japan report that Japanese ophthalmologists have a real need for recent, first-rate ophthalmic literature. This need is strongest in the field of American and British textbooks copyrighted after 1940 as well as for complete volumes of journals of the same period.

Shortly after the close of World War II, the Lucien Howe Library of Ophthalmology acted as agent for the distribution of wartime American publications on ophthalmology to various foreign centers and investigators. This library is ready to assume this role again. A fund established by Mrs. Elizabeth Proctor is still available to defray costs.

Donations of literature of the type described should be sent to Charles Snyder, librarian, Lucien Howe Library of Ophthalmology, 243 Charles Street, Boston 14, Massachusetts. Donors will be repaid for postal charges.

(Signed) Charles Snyder,
Librarian.

BOOK REVIEWS

Slit-Lamp Microscopy of the Posterior Section of the Eye. By Dr. Karl Hruby. Wien and Innsbruck, Urban & Schwarzenberg, 1950. 164 pages, 20 black and white illustrations, eight color plates. Price: $6.80.

Hruby reports the results of investigations begun in 1939 in a field that has received little attention. The development from Koeppe's contact lens and silver mirror of 1922 to his preset lens is briefly reviewed.

This preset lens, together with Goldmann's reduction prism, simplifies the technique so that examination of the posterior section of the globe—formerly a complicated procedure of mostly theoretical and

scientific interest—may become accepted for everyday clinical examination. The prism permits reduction of the angle between the light beam and microscope tube to five degrees. The preset lens (−55 diopters) is easier to manipulate than a contact lens; it can be used in examination of children and recently operated or traumatized eyes. It can be rotated so that the line of vision is always through the lens center; thus the periphery of the fundus close to the ora can be studied.

As in biomicroscopy of the anterior section, direct and indirect illumination, direct and indirect retroillumination and, for certain purposes, even specular reflection can be used.

There are chapters on study of the vitreous, on retinal detachment, and on pathologic conditions of the fundus.

After discussion of normal structure of the vitreous, the morbid changes are presented, particularly various forms of detachment. Hruby's research forced creation of a new classification and nomenclature in an almost new field. He also surprisingly brings forth that detachment of the vitreous is not a rare occurrence of only theoretical interest; any formed opacities recognizable with the ophthalmoscope are highly suggestive of vitreous detachment. It is an almost constant feature in axial myopia, especially in older individuals and frequently occurs with pigment degeneration of the retina, after contusion of the globe, and after perforating wounds and intraocular operations.

In "vitreous hemorrhages" and retinitis proliferans, the hemorrhages and newly formed tissues are limited to the postvitreal space, and are unable to penetrate into the vitreous proper. No cases were seen where vitreous detachment alone caused serious damage to the vision. Since there is no known treatment, it is mostly of diagnostic significance.

Retinal detachment seems always to be accompanied by vitreous detachment. While vitreous detachment can be assumed as the primary cause in idiopathic detachment (thus further supporting the theory of Leber, Gonin, and Lindner), it seems to be a secondary change after traumatic detachment. Idiopathic detachment can be differentiated by the operculum being adherent to the vitreous. Also, the type of vitreous detachment allows prediction of success of surgery, particularly if a shortening operation is planned. Slitlamp study of the posterior section of the globe is a valuable adjunct in evaluation of surgical results.

The chapter on the fundus is brief but complete; it avoids repetition of ground adequately covered by Koeppe and Meesmann. Choroiditis centralis serosa is the one syndrome treated in detail. There is extensive review of the literature, as well as the clinical findings, including their appearance under the slitlamp. Hruby apologizes in the preface for articles in foreign literature since the outbreak of World War II that may have been neglected; this may account for no mention of Sanford R. Gifford's studies on central angiospastic retinopathy.

This volume should interest every ophthalmologist. It contains a wealth of material in minimum space. The chapters on detachment of the vitreous and the retina open new vistas. The illustrations, especially in color, are excellent. Nevertheless, it is questionable whether even the best illustrations can adequately substitute for an introductory course to assist the novice in evaluating clinical appearance.

Time will tell whether information obtained by slitlamp study of the posterior section of the globe is important enough to call for the changed construction necessary to make present models suitable for such work. Provision can easily be made for a preset lens and reduction prism; it also seems essential to have an arrangement to move the slitlamp arm and microscope so that both are always focussed simultaneously as there are no suitable reference points between the posterior surface of the lens and

the retina. The only instruments currently available that fill this requirement are the Haag-Streit slitlamp and the new Littmann slitlamp manufactured by Zeiss-Opton. The Hruby preset lens can be obtained from A. H. Parsons, San Francisco.

Stefan Van Wien.

BULLETIN OF THE OPHTHALMOLOGICAL SOCIETY OF EGYPT. Volume 39, 1946; Volume 40, 1947.

In Volume 39, A. El-Sayed Handausa Bey presents a very complete study of proptosis, including several interesting illustrations.

Abd El Aziz Sami, Ibrahim Alunad Mohammad, Fahim Girgis Ibrahim, and Sabri Kamel contribute a symposium on tuberculosis. They compare the relationship of generalized tuberculosis and ocular tuberculosis, which in their opinion is quite rare unless phlyctenular keratoconjunctivitis is considered to be tuberculous. Generally, supportive treatment is the treatment of choice and great care should be exercised when using tuberculin.

A rigid but adjustable splint for the reformation of a contracted socket was demonstrated and discussed by Maxwell Lyons. The fixed point is a frontal pin embedded in a plaster-of-Paris headcap. To this the mold is attached by stainless steel rods and universal clamps. The molds are especially made from acrylic resin and shaped like large artificial eyes. Each mold has embedded in it, below the anterior surface, a small stainless steel nut into which a short steel rod, threaded at one end, can be screwed. A suitable stock of molds is available at the time of operation.

Gamel Badir observed a case of schistosomiasis of the conjunctiva. He is able to demonstrate the cercariae in a histopathologic specimen of the subconjunctiva.

M. H. H. Attiah reports on penicillin treatment in eye diseases in 1945, and mentions its limited value in the acute ophthalmias in Egypt. It is ineffective against the Koch-Weeks bacillus.

H. H. Gaafar supports a more conservative treatment in perforating eye injury and suggests an observation period of one or two weeks in doubtful cases before sacrificing the eyeball.

The highlight in Volume 40 is the Soliman Lecture, delivered by M. Khali who, after a short review on the achievements of the ophthalmologists of Egypt, discusses the history of contact lenses and their fitting. He also showed two movies on corneal transplants and gave the necessary introduction and interpretation. He had studied these two subjects and many others during his three months' stay in the United States as a representative of his society at the conference of the International Society for the Prevention of Blindness in New York.

Another Egyptian guest at this meeting was Hassan Bey Barrada, the representative of the ministry of Public Health. Hassan Bey Barrada gives a more detailed report on his visit to the United States and makes many suggestions on how his government could help by promoting glaucoma clinics, eye-banks for corneal grafting, sight-saving classes, establishments for fitting contact lenses, and orthoptic training and by indorsing a preventive program for the industrial medical services.

Kattan Bey and Osman Youseff treated a large angioma of the conjunctiva successfully with diathermy. The strength of the current was tested beforehand on a piece of meat and the weakest current which showed a reaction was used. Six treatments were given in five days, a different area being treated each time. Monopolar electrodessication was used on the feeding vessels at the last sitting.

There are several papers on glaucoma operations, among them an evaluation of iris-inclusion operations by Kattan Bey and Osman Youseff, and the demonstration of a new knife for the separation of the cornea in trephining by El Said Kh. Abu Shousha.

F. Maxwell Lyons reports an interesting experiment—the mass treatment of acute ophthalmias in the villages of Egypt. M. H. A. Attiah and M. A. M. Labib discuss the epidemiology of the Echinococcus, the development, pathogenicity, and symptomatology of the hydatid cyst, and they read a case report on an orbital Echinococcus cyst.

Gamel Badir has some preliminary notes on experiments with lemon juice and onion juice and their effects on the growth of the gonococcus and other pathogenic conjunctival flora in vitro. As it is the common practice among the general population in Egypt, whether in the country or in the cities, to put onion juice or lemon juice into the eyes of the newborn babies this practice may be the cause of the slight incidence of ophthalmia neonatorum in Egypt in the presence of such a frequent occurrence in older children and adults.

Alice R. Deutsch.

BLINDNESS. Edited by Paul A. Zahl. Princeton, New Jersey, Princeton University Press, 1950. 576 pages, 21 illustrations, references, index. Price: $7.50.

The editor, associate director of the Haskins Laboratories, New York, has skilfully blended the contributions of 31 authorities on the blind into a fine compilation. There are seven parts: (1) History and welfare; (2) education and psychology; (3) vocational considerations; (4) the military blinded; (5) time-tested boons to the blind; (6) exploration of new technicological horizons; (7) ophthalmological factors.

Ten of the contributors are themselves blind. The most famous of this group, perhaps, are Sir Ian Fraser, chairman of the famed St. Dunstan's in Great Britain, where during World War II, 17 blinded American servicemen received part of their training on how to be blind; Lloyd Greenwood, executive director, Blinded Veterans Organization; Col. E. A. Baker, managing director, the Canadian Institute for the Blind, Toronto; and Dr. Robert B. Irwin, associate director, American Foundation for the Blind. All of the contributors are, however, widely known for their work with the blind.

The book is interesting and well written. It includes everything known about blindness, and the chapter on exploration of new techniques is particularly good.

Every ophthalmologist sees blindness, often early in the experience of his patient. He needs to know everything he can about this distressing affliction. There is room for optimism ever here, with the modern advances explained in these pages, and this optimism must be transferred into action for the welfare of his patient. It is, therefore, highly necessary that the ophthalmologist own and read this book so that he more intelligently understands this problem.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Dobree, J. H. **Superficial perilimbal vessels in the normal and congested eye.** Brit. J. Ophth. **34**:720-726, Dec., 1950.

The arterioles (15 to 25 in number) of the perilimbal conjunctiva originate from the deep arteries of the limbal area, are branches of the anterior ciliary artery, turn sharply forwards from the deep origin and run outwards from 3 to 6 mm. The blood returns via accompanying veins. The remainder of the conjunctiva is chiefly supplied by the vessels lying in the region of the fornices. In congestion the veins increase greatly in caliber, fresh channels are opened and anastomosis between the perilimbal and peripheral vessels are seen. If the congestion is severe, the blood flow may be reversed through the anastomotic channels. Marginal corneal loops are present which arise from the deep episcleral vessels. A rapid spurting of blood can often be made out in the arterial channels. In the venous limbs the flow is slower and frequently "granular." The changes in form and blood flow in the superficial vessels is shown to be closely related to the deeper vessels from which they derive. Orwyn H. Ellis.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Charnwood, Lord. **Influence of alcohol on fusion.** Brit. J. Ophth. **34**:733-736, Dec., 1950.

The results of vertical fusional measurements after ingestion of measured amounts of alcohol in a small group of subjects are reported. Although considerable variation in findings was recorded the total readings showed surprisingly smooth curves both individually and collectively. Alcoholic diplopia is due both to reduction power of overcoming diplopia and increased difficulty in suppressing the double image; diplopia occurring in acute exanthemata may be due to a toxic action comparable to that of alcohol.

Orwyn H. Ellis.

D'Ermo, F., and Salvi, G. L. **Antihistamin drugs and the eye; action on the conjunctival flora.** Boll. d'ocul. **30**:3-11, Jan., 1951.

The antibacterial action of antergan,

neoantergan, pyribenzamine, benadryl, thephorin, antistin and fargan on staphylococcus pyogenes albus and aureus, streptococcus, pneumococcus, Morax-Axenfeld bacillus, xerosisbacillus and Koch-Weeks bacillus was studied in vitro, using dilutions of the antihistamine drugs between 1/1,000 and 1/20,000, keeping the pH between 7.2 and 7.4 and the temperature at 37°C. The results are clearly reported in seven tables. A definite antibacterial action can be attributed to all of the drugs named, strongest in the experiments with antergan, pyribenzamine and fargan. Staphylococci and streptococci were easily destroyed while least effect was found on Morax-Axenfeld and Koch-Weeks bacilli. No parallelism to the antihistaminic action was detected.

K. W. Ascher.

Giardini, A., and Roberts, J. **Concentration of glucose and total chloride in tears.** Brit. J. Ophth. **34**:737-743, Dec., 1950.

The concentration of glucose and chloride at progressive steps of lacrimation are reported. The true glucose of tears averaged 41 percent of the total reducing substances compared to 81 percent concentration in the same subject's bood. During continuous lacrimation there was such variability between samples that no generalization could be made. The total chloride in tears measured 135.5 mM. and showed progressive dilution with increased lacrimation. The dry weight of tears was 1.84 percent.

Orwyn H. Ellis.

Reis, J. L. **Phosphatase activity in the ocular tissues.** Brit. J. Ophth. **35**:149-152, March, 1951.

Phosphatases have frequently been demonstrated in ocular tissues, although their function has not yet been ascertained. In addition to the alkaline phosphatase which occurs in the cornea there is present a specific phosphatase chiefly in the retina and choroid, 5-nucleotidase, which is much more active than the alkaline phosphatase. 5-nucleotidase was isolated from human eyes and its activity measured in various pH concentrations; it was found to be very active at physiological pH while at this pH alkaline phosphatase was relatively inactive.

Morris Kaplan.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Chan, E. and Mao, W. S. **Colour-blindness among the Chinese.** Brit. J. Ophth. **34**:744-745, Dec., 1950.

Eleven thousand Chinese were examined for color-blindness. The figure of 5 percent for males agrees with the previously reported summaries, but 0.7 percent for females is about half that of previous reports. Orwyn H. Ellis.

Goldmann, H. **Observations on objective visual acuity determination.** Klin. Monatsbl. f. Augenh. **117**:570-573, Dec., 1950.

As an objective visual acuity determination, only one method is definite and that is derived from the separable minimum rather than the visible minimum. This condition does not fulfill Ohm's method, but does fulfill the one the author suggested previously and the one suggested by Gunther.

Theodore M. Shapira.

Monjé, M., and Schober, H. **Comparative examination with visual tests to determine distance vision.** Klin. Monatsbl. f. Augenh. **117**:561-570, Dec., 1950.

Comparative measurements of vision are recorded with the aid of Schweigger's tests, in a transparent box, and the Pflüger hooks, Landolt rings, numerals, and the Schobersch visual projector. It

is shown that the Schweigger tests, and the Pflüger hooks give the same visual values, while the Landolt rings and the numerals were similar; but as compared with the first two, they have less visual value. The reason lies in the various values for individual tests. The Landolt ring corresponds to the international norm. The blackness of the figures has no influence in the results.

Theodore M. Shapira.

Pugh, Mary. **Brightness perception and binocular adaptation.** Brit. J. Ophth. **35**: 134-142, March, 1951.

It has long been noticed that there frequently exists a difference in the brightness of illumination appreciated by the two eyes, especially in cases of heterophoria or heterotropia. This diminished sense of brightness may be present with equally measured vision or with little or no difference in the refraction of the eyes. An intelligent patient frequently realizes that the vision on the chart measures the same, yet one eye seems better than the other. This difference is equally noted on black and white and in colors and is particularly demonstrable with ordinary color-vision plates.

In this report 100 patients were tested for this phenomenon and the results recorded and charted. Half the patients had previously had amblyopia ex anopsia which had either been cured entirely or greatly improved and the other half had no anisometropia. The tests were done on an orthoscope with meticulous control of lighting and in each the dominant eye was compared against the non-dominant eye. The results demonstrated that a diminished light sensitivity balance is present in a very high proportion of persons. It may be present without affecting the visual acuity but when there is a reduction in the visual acuity this light sensitivity is always reduced.

Morris Kaplan.

Sondermann, R. **The origin of myopia.** Klin. Monatsbl. f. Augenh. **117**:573-578, Dec., 1950.

A new theory is suggested for the origin of myopia. During the middle fetal months a ballooned curvature of the choroid occurs which normally disappears at birth, but in myopia, it either remains or, on the contrary, it leaves a lowered intraocular pressure.

Theodore M. Shapira.

Wilner, B. I., Weymouth, F. W., and Hirsch, M. J. **Distance discrimination. VIII. Influence of rod brightness and background illumination in Howard-Dolman test.** A.M.A. Arch. Ophth. **45**:523-527, May, 1951.

From examination of 512 binocular distance discrimination readings made by eight subjects with the Howard-Dolman apparatus altered to obtain extremes in rod brightness and levels of background illumination, the following points were demonstrated. The level of background illumination may influence the position of subjective equality (E_s) regardless of the reflectivities or brightnesses of the pairs of rods when the reflectivities of the rod pairs are identical; this effect is greater with rods of high than with rods of low reflectivity. The reflectivity of the rods does not affect the E_s with either high or low levels of background illumination when the reflectivities of the rod pairs are identical. The shift from bright to dim levels of background illumination in the case of pairs of rods of differing reflectivities causes the brighter rod to be placed farther from the subject than the dull rod.

R. W. Danielson.

5

DIAGNOSIS AND THERAPY

Boase, A. J. **Blue-print for a corneal trephine.** Brit. J. Ophth. **35**:248-250, April, 1951.

The instrument consists of an outer housing which attaches to the cornea with small hooks. A suture is put through the disc to be excised and the cutting blade turned by the handle above so that the disc is excised without the risk of compression of the globe as the cornea is held on the stretch inside and outside. The blades first penetrate the cornea, then the cut is continued perpendicular to the corneal surface. Orwyn H. Ellis.

Davidson, H. H., Hill, J. H., and Eastman, N. J. **Penicillin in the prophylaxis of ophthalmia neonatorum.** J. A. M. A. **145**:1052-1055, April 7, 1951.

In 9,241 consecutive newborn infants given 50,000 units of penicillin intramuscularly for prophylaxis against gonorrheal ophthalmia, not a single case of this disease developed. This dose was equally effective when given locally in over 4,000 cases. Irwin E. Gaynon.

Fenwick, G. de L. **A flock-sprayed test-object holder.** Brit. J. Ophth. **35**:168-, March, 1951.

A method of spraying the holder of test objects for field testing with black rayon is described which makes the holder more invisible to the patient.

Morris Kaplan.

Foster, John. **Appliance: a snare to reduce post-excisional haemorrhage.** Brit. J. Ophth. **34**:757-758, Dec., 1950.

This small, simple snare for cutting the optic nerve in enucleation eliminates the difficulties with former instruments and is easy to operate. A long section of the optic nerve can be obtained by pushing the snare as far back as possible before cutting the nerve. Hemorrhage has been negligible. Orwyn H. Ellis.

Huerkamp, B., and Wagner, O. **The action of mintacol on the pupil and intraocular tension.** Klin. Monatsbl. f. Augenh. **117**:586-591, Dec., 1950.

The authors tried the new miotic diethyl-p-nitrophenol phosphate on rabbits and human eyes and after 200 cases observed clinically, they recommend it most highly. The reduction of intraocular pressure is as good as, or better than, that which follows the use of eserine and pilocarpine. It is especially valuable to counteract the mydriasis that follows the installation of drugs.

Theodore M. Shapira.

Juler, F. A. **Appliances: projection scotometer.** Brit. J. Ophth. **35**:246-247, April, 1951.

This projection scotometer may be used as a simple hand model or placed on a stand with pivot. An auto-registration mechanism is attached to the stand. The instrument avoids reflection from the holder of a target and distraction by the operator's arm. Pins are not required as the results are marked as the examination progresses. Orwyn H. Ellis.

Kuhn, H. S. **Sodium sulfacetamide in ophthalmology.** Tr. Am. Acad. Ophth. pp. 431-435, March-April, 1951.

Especially in industrial ophthalmology, the author considers sodium sulfacetamide the most satisfactory of the sulfonamides because of its greater solubility, its practical effective bacteriostatic power in the ocular tissues, and its low toxicity. As a prophylactic after industrial injuries, both mechanical and chemical, the 10-percent ointment and the 30-percent solution or both are employed topically. Usually after removal of ocular foreign bodies the 10-percent ointment and a patch are applied. If subsequently necessary, the 30-percent solution is instilled three times daily.

Chas. A. Bahn.

Maurice, D. M. **An aplanation tonometer of new principle.** Brit. J. Ophth. **35**:178-182, March, 1951.

The ordinary impression type of tonometer is probably sufficiently accurate for most clinical purposes, but for problems of intraocular fluid dynamics a more sensitive and true instrument should be available. The author has designed one which employs the principle of pressing an inflated, thin rubber surface against the cornea. This results in the establishment of a plane surface when the pressure inside is made equal to the intraocular pressure. The apparatus is extremely sensitive and accurate but has the disadvantage that the readings vary with the pulse and respiratory rhythm of the intraocular pressure.

Morris Kaplan.

Maurice, D. M., and Giardini, A. A. **A simple optical apparatus for measuring the corneal thickness and the average thickness of the human cornea.** Brit. J. Ophth. **35**:169-177, March, 1951.

The authors have devised an attachment for the Haag-Streit slitlamp which can be used in measuring the thickness of the cornea with an acceptable degree of accuracy. On 44 human subjects the mean value for the minimum corneal thickness was found to be 0.507 mm., the mean for women being 0.004 mm. higher than that for the men. Morris Kaplan.

McWilliams, R. J., and Wilson, T. **Aureomycin borate in external ocular conditions.** Brit. J. Ophth. **35**:153-159, March, 1951.

Seventeen cases of especially picked severe external eye diseases were treated with aureomycin borate as instillation drops with no oral aureomycin and no other treatment. The patients were all in a hospital and the drug instilled every two hours in each eye day and night for three days with frequent observations and cultures. Most patients received only one course of 60 to 75 mg. of the drug. Four cases of chronic conjunctivitis of years' duration were cured rapidly but in the other 13 cases there was little or no improvement. There were 11 cases of keratitis of various causes, one marginal corneal dystrophy and one of orbital cellulitis. No toxic or other untoward effects were noted. It was concluded that aureomycin borate had no therapeutic advantage over more usual, less expensive and more readily available (in Britain) remedies. American workers have reported favorable results in the virus diseases; these results were not substantiated here. Morris Kaplan.

Mundy, W. L., Howard, R. M., Stillman, P. H., and Bevans, M. **Cortisone therapy in case of rheumatoid nodules of the eye in chronic rheumatoid arthritis.** A.M.A. Arch. Ophth. **45**:531-538, May, 1951.

In a white woman aged 50, with a history of rheumatoid arthritis for eight years, there developed rheumatoid nodules of the episcleras. Local cortisone therapy caused initial amelioration of the ocular disease, but when treatment was stopped a severe exacerbation of the nodules, iridocyclitis and glaucoma occurred. Intramuscular administration of cortisone brought about disappearance of the nodular formations and subsidence of the intraocular processes. R. W. Danielson.

Woods, A. C., Wood, R. M., and Naquin, H. A. **Studies in experimental ocular tuberculosis. XV. Effect of paraaminosalicylic acid and of streptomycin plus paraaminosalicylic acid in normal rabbits.** A.M.A. Arch. Ophth. **45**:546-554, May, 1951.

In these experiments paraaminosalicylic acid was found to have a definite and deterrent effect on the course of experimental ocular tuberculosis. In combination with streptomycin the deterrent effect is much more striking and about as

effective as combined use of streptomycin and thiazolsulfone (promizole).

R. W. Danielson.

6

OCULAR MOTILITY

Banerjee, B. D. **Abnormal insertion of inferior oblique.** Brit. J. Ophth. **34**:756, Dec., 1950.

At operation it was found that the insertion of the inferior oblique muscle was anterior to its normal position and the tendon blended with that of the external rectus and then inserted by a common tendon into the sclera. A second insertion of the inferior oblique muscle was not found. Orwyn H. Ellis.

Krimsky, Emanuel. **Method for objective investigation of strabismus.** J. A. M. A. **145**:539-544, Feb. 24, 1951.

Significant corneal light reflexes may be elicited and used in objective evaluation of strabismus. The position of the corneal reflex in a fixing eye is the pivotal point in determining whether the eye is straight. Gaze into a flashlight held just beneath the dominant eye of the examiner determines the location of this fixational corneal light reflex. Unless the visual axes of the two eyes meet at the common point, deviation is present, and the corneal light reflex is displaced in the opposite direction to the deviation. It is thus possible to determine the ocular position and function without questioning the patient, and using only flashlight and prism. Data are obtainable concerning monocular fixation, binocular fixation in normally straight eyes, status in manifest strabismus, and differentiation of visual suppression from prism convergence.

The corneal light reflex shows the state of binocular balance, position and function and is the only dependable guide for objective evaluation of manifest strabismus. The amount of strabismus may be measured with the prism reflex test.

Claude L. LaRue.

Paufique, L., and Hugonnier, R. **The surgical treatment of old superior oblique paralyses.** Ann. d'ocul. **184**:193-205, March, 1951.

The operative pattern suggested is sound and worthy of wider understanding. After superior oblique paralysis, secondary involvements potentially occur in the following order: a. overaction of the homolateral antagonist (inferior oblique); b. overaction of the contralateral synergist (inferior rectus); c. underaction of the contralateral antagonist (superior rectus). The author suggests surgical treatment in the same order and discusses two illustrative cases.

In the first case the patient had a distressing diplopia following an injury in World War I which caused a left superior oblique paralysis. The operative treatment was myectomy of the left inferior oblique (homolateral antagonist) and recession of the right inferior rectus (contralateral synergist). Because of continued but lessened diplopia after three months, resection of the right superior rectus (contralateral antagonist) was not necessary. The second case reported is basically similar. Prisms not exceeding three degrees are of value in some cases.

Chas. A. Bahn.

Van Heuven, J. A. **Some observations on convergence.** J. Internat. Coll. Surg. **15**:337-365, March, 1951.

Convergence insufficiency and convergence excess are of vast importance clinically. There has been great confusion regarding the action of the external eye muscles and convergence insufficiency. Symptoms are fatigue after near vision, absent in the mornings but occurring after using eyes during the day. They vary

with the patient's general condition and are much worse in the neurotic individual. There are many causes of these symptoms, such as imperfection in the muscular apparatus secondary to physical or mental weakness, or as an upset of the normal ratio between accommodation and convergence, or as combinations of these factors. The chief sign of convergence insufficiency is difficulty to converge on approaching the near point, deviation always being larger at the near point than at distance—the reverse of divergence excess. With the Maddox rod at 20 feet there is orthophoria and with the Maddox wing at 13 inches exophoria always exceeds 6 degrees.

Treatment to be successful should include accurate diagnosis, care of psychological factors and general condition, careful refraction with full correction for myopes and slight undercorrection for hyperopes. In presbyopes the relation between convergence and accommodation is a problem. Prisms are often indicated in near correction and two pairs of glasses rather than bifocals are advisable. Most important in treatment are prism exercises, "pin to nose" exercises and the use of one of the amblyoscopes.

In convergence excess the symptoms are difficulty in reading and headaches. Spasm of convergence with myosis and excessive accommodation are frequent, especially in neurotics. The signs are marked esophoria, relatively greater for near than for far and increased prism convergence with normal prism divergence. The causes are excessive near work in children and voluntary convergence leading to convergence excess. The latter makes indiscriminate muscle training potentially harmful. The nervous factor is important. Treatment consists of correction of refraction and heterophoria, good illumination and close work kept far removed from the eyes. Orthoptic treatment is of questionable value, although Utermöhlen prescribes prisms. Many case reports show favorable results.

Claude L. LaRue.

7

CONJUNCTIVA, CORNEA, SCLERA

Bruna, F. **Fehr's dot-like corneal dystrophy.** Boll. d'ocul. **30**:39-55, Jan., 1951.

Clinical and biomicroscopic findings corresponded with the diagnosis of spotted corneal dystrophy (Fehr); in one eye, the visual acuity was improved from counting of fingers to 8/10 after corneal transplantation. The removed flap was thoroughly studied. With May-Gruinwald and with Giemsa stain, one eosinophile and one basophile substance were found, as in previous cases. Faint staining was obtained with Weigert's method; thionine did not show evidence of a mucoid character of the substances involved. (4 photomicrographs, 35 references)

K. W. Ascher.

Doggart, J. H. **Vascularization of the cornea.** Brit. J. Ophth. **35**:160-167, March, 1951.

Vascularization of the cornea and the conditions which cause it seem to be occurring more frequently. Some of the conditions in which the appearence and persistence of these adventitious vessels may be found are: phlyctenular disease, interstitial keratitis, sclerosing keratitis, disciform keratitis, trachoma, rosacea, various ulcers, mechanical irritation, chemical damage, intraocular disorganization, nutritional disturbance and some of the dystrophies. The method of vascularizations, the depth of the vessels and their location on the cornea, and associated signs of disease elsewhere in the body are of help in differential diagnosis. Although these vessels benefited the diseased cornea by the excess of blood supply, their persistence and the progressive increase of the vessels damage the cornea

and vision. Experimental work has cleared some of the mechanical explanation of the process although much of this work has been done on the rabbit whose physiology of the cornea is entirely different. Morris Kaplan.

Gaard, D. P. **Trachoma and national service.** Rev. Intern. du Trachome **28**:11-18, 1951.

With the advent of conscription in Malta in 1941 a survey showed that families with adequate income were trachoma free but that the incidence among the rest was over 5 percent. Those affected were rejected because of the danger to noninfected personnel, the inefficiency induced by photophobia and tearing and the probable problem of compensation. Where trachoma is rife, as in Algeria, the exclusion of everyone affected with trachoma would seriously deplete man power. The French army therefore placed the milder cases in a trachoma corps. James E. Lebensohn.

Jebejian, R. **Data on endemic trachoma and its significance in trachoma control.** Rev. Intern. du Trachome **28**:45-55, 1951.

A slitlamp study of 495 school children over 10 years of age showed that complete healing had spontaneously occurred in half of them. Secondary infection seriously altered the prognosis.

James E. Lebensohn.

Krepuscinski, W. **Abortive forms of trachoma.** Rev. Intern. du Trachome **28**:37-44, 1951.

The author had the opportunity to observe 31 persons who had one of their eyes inoculated with trachoma to avoid service in the German army. In 20 cases the companion eye became spontaneously affected. Of 55 eyes seen from the commencement of the infection to resolution, an acute course occurred in 44 and subacute in 11. The incubation period was five to seven days. The most frequent occurrence was an acute conjunctivitis with papillary hypertrophy which healed without complications although some cases were serious with typical sequelae.

James E. Lebensohn.

Kronenberg, Bernard. **A further report on the use of ether in the treatment of herpetic keratitis.** N.Y. St. J.M. **50**:2825, Dec., 1950.

The eye is anesthetized with 1-percent pontocaine. The lesion is outlined with fluoresceine. The lesion is rubbed, removing the corneal epithelium, with a tightly woven small cotton applicator dipped into fresh ether. It must be rubbed in. Metaphen ointment is instilled and the eye bandaged. The patient is re-examined in 24 hours and if there is any vestige, the procedure is repeated. The eye should be occluded for 72 hours.

Irwin E. Gaynon.

Linnen, H. J. **Slitlamp observations on the closure mechanism of corneal wounds after trephine on guinea pigs' eyes.** Klin. Monatsbl. f. Augenh. **117**:606-611, Dec., 1950.

The author made 1 mm. central corneal trephine openings in guinea pigs' eyes to observe whether healing was due to processes in the epithelium, or to keratoblast formation, to active interstitial formation of fixed corneal cells, to participation of the endothelium or to other factors. Large perforating injuries of the cornea cause changes in the aqueous and reduction of the intraocular pressure, both of which affect the process. Linnen describes three stages. 1. With exit of the aqueous, the lens and iris come forward, the corneal concavity lessens, the trephine opening becomes constricted ovally in the area of the endothelium and fibrin begins to form just posterior to the cor-

neal opening; 2. The anterior chamber begins to reform slightly, the iris still is pushed forward. The cornea resumes its convex form, thus the trephine opening is reversed in position and the fibrin plug is caught in the opening, thus closing the opening; 3. The anterior chamber is reformed with traction visible in the cornea on its convex curvature. By his experiments he established that the healing is a very complex affair concerned with change in position of the iris and lens and changed aqueous flow and also with the participation of changes in corneal position due to emptying of the anterior chamber and its reformation. The observations with the slitlamp were compared with the previous histologic findings of Salzer with whom the author is not wholly in agreement.

Theodore M. Shapira.

Pagés, R. **The role of acute seasonal conjunctivitis in the evolution of trachoma.** Rev. Intern. du Trachome **28**:81-172, 1951.

Acute conjunctivitis favors trachoma infection in previously healthy eyes. Numerous children have been observed in whom trachoma first appeared after an attack of acute conjunctivitis. Fifty children at the Memorial Ophthalmic Hospital in Giza became infected with Koch-Weeks conjunctivitis when about one year old and 34 contracted trachoma a few months later. The rapid cure of acute forms of conjunctivitis protects the eye from trachoma invasion. Consequently the armies operating in northern Africa in World War II were not affected as were those in the Napoleonic era. Flies play an important role in the distribution of bacteria. In one Kasbah the repeated use of D.D.T. caused the incidence of acute conjunctivitis to fall 50 percent. The famous 11th century oculist of Bagdad, Ali Ibn Isa, had noted the interrelationship of ophthalmia and trachoma and insisted that the ophthalmia must be controlled first.

James E. Lebensohn.

Paufique, L. and Philps, S. **Case notes: acute eye lesions treated by lamellar corneal grafting.** Brit. J. Ophth. **34**:746-748, Dec., 1950.

One of the patients described had a progressive deep ulcer that did not respond to any treatment, but healed rapidly after a lamellar corneal graft was applied and held in place with direct suturing. In the second a large chemically burned area was excised and a lamellar corneal graft was held in place with mattress sutures. Both patients retained useful vision. Orwyn H. Ellis.

Poleff, L. **Clinical and experimental study of secondary bacterial infection in trachoma.** Rev. Intern. du Trachome **28**: 59-64, 1951.

Secondary infection with Koch-Weeks bacillus in trachoma was studied in clinic patients and also on a blind person experimentally infected with trachoma. The secondary infection produces an aggravation of the disease and intensifies the number of trachoma corpuscles present, and consequently renders the patient more infectious. James E. Lebensohn.

Poleff, L., and Viennot-Bourgin, M. **The local application of sulfonamides and antibiotics in a case of experimental pure trachoma.** Rev. Intern. du Trachome **28**:19-36, 1951.

Both eyes of a blind patient with healthy conjunctiva were inoculated with trachoma and carefully observed for five months until cure resulted. Streptomycin, penicillin and the sulfonamides were practically without effect but the application of aureomycin ointment every three hours hastened resolution.

James E. Lebensohn.

Toulant, P., Larmande, A., and Toulant, M. **Classification of trachomatous pannus.** Rev. Intern. du Trachome **28**:7-10, 1951.

The true trachomatous pannus consists of a superficial cellular infiltration of the upper fifth of the cornea associated with palisade vascularization. It is of diagnostic significance and must be differentiated from two other types occurring in trachoma—that incidental to mechanical irritation from trichiasis and entropion, and that due to healed cicatricial changes in the corneal epithelium (pseudo-pannus) which is unaccompanied by photophobia and blepharospasm.

James E. Lebensohn.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Funk, V. A. **Melanoma of the iris.** Delaware St. M. J. **23**:59-62, March, 1951.

A melanoma of the iris was removed by iridectomy. Classification, pathology, and treatment are discussed.

Irwin E. Gaynon.

9

GLAUCOMA AND OCULAR TENSION

Greaves, D. P., and Perkins, E. S. **Buphthalmos in the rabbit.** Brit. J. Ophth. **35**:232-233, April, 1951.

Congenital glaucoma was found in two rabbits supplied for experiments. No vessels resembling aqueous veins could be found. Experiments performed with injected dyes suggest that normally drainage occurs from the eye to the episcleral vessels, but little aqueous drains by this route in buphthalmic eyes.

Orwyn H. Ellis.

Schmöger, Elizabeth. **Experiences with trephine cyclodialysis in glaucoma.** Klin. Monatsbl. f. Augenh. **117**:598-606, Dec., 1950.

The author has reviewed the available literature since 1947, although Sallmann first described the procedure in 1933. She reviews 60 cases of trephine cyclodialysis done on eyes with various types of glaucoma and compares them with simple cyclodialysis which gave better results because there were fewer complications. The trephine opening is made 6 to 7 mm. from the limbus in the lower temporal quadrant. Trephine cyclodialysis is effective in the same manner as simple cyclodialysis and the author doubts that the added fistula affects the result.

Theodore M. Shapira.

10

CRYSTALLINE LENS

Bignell, J. L. **Case notes: folds in the lens capsule after trauma. A sign of partial rupture of the zonule.** Brit. J. Ophth. **35**:234-236, April, 1951.

Folds in the lens capsule after trauma were interpreted as sign of partial rupture of the zonule. Localized iridodonesis, deep anterior chamber, and change of refraction were present and were thought to be due to unequal tension of the zonule. These folds appeared as parallel shadows when viewed by retro-illumination and the undulating surface of the lens was seen on the slit lamp examination.

Orwyn H. Ellis.

Cogan, D. G., and Donaldson, D. D. **Experimental radiation cataracts: 1. Cataracts in the rabbit following single X-ray exposure.** A.M.A. Arch. Ophth. **45**:508-522, May, 1951.

With X rays of 200 and 1,200 kv energy in doses of 250 to 3,000 r and rabbits of ages ranging from three weeks to three years, the following effects were noted. Epilation occurred in 15 to 35 days with doses of 1,500 r or greater, came on sooner and were more profound the larger the dose and the less the energy

of the X rays. The threshold dose for epilation was 1,500 r for the 1,000 kv. and 1,000 r for the 200 kv. level. Cataracts likewise occurred with a latent period that was an inverse function of the dose; but, in contrast to the phenomena of epilation and keraconjunctivitis, the threshold dose for 10-week-old rabbits was 250 r or less, and the latent period for the development of radiation cataracts was much less, the younger the animal. With doses of X ray (1,200 kv.) of less than 1,000 r, cataracts were the only abnormality produced. Cytological changes in the lens epithelium appeared to be characteristic of irradiation and could be found before any clinical evidence of cataract. R. W. Danielson.

Guha, G. S. **Soemmering's ring and its dislocations.** Brit. J. Ophth. **35**:226-231, April, 1951.

Soemmering's ring is a special form of after-cataract. Dislocation of Soemmering's ring may be caused by formation at early age, myopia, senile changes in the eye, degeneration changes in the ring, trauma, and spontaneously. Soemmering's ring differs from ordinary after-cataract in that it is usually clinically invisible and that it dislocates easily.

Orwyn H. Ellis.

11

RETINA AND VITREOUS

Ashton, Norman. **Retinal micro-aneurysms in the non-diabetic subject.** Brit. J. Ophth. **35**:189-212, April, 1951.

To ascertain the incidence of retinal micro-aneurysms in non-diabetics 336 eyes were examined by staining and injection. The injection method of preparation was found to give better results than staining and aneurysms were not produced as artefacts. After operation, when the retinal vessels were clearly seen, one-third showed micro-aneurysms and these were most common in cases of thrombotic glaucoma and chronic uveitis, and in an eye with uveitis after a perforating injury. In one case of retinoblastoma, micro-aneurysms were demonstrated in the tumor only, probably related to the abnormal vascular growth present. In eyes removed at autopsy, again about one-third showed micro-aneurysms. When no eye disease was suspected, about 29 percent of cases had retinal micro-aneurysms. The lesions were few, limited to the periphery of the field and often indistinguishable from the diabetic type. Micro-aneurysms were as commonly absent as present in cases of chronic cardiac or pulmonary disease. The capillary changes consisted of a focal mural degeneration which involved the basement membrane. This lead to increased permeability of the vessel wall or to rupture and hemorrhage. In the retina there may be an intermediate stage. The obstruction which follows thrombosis of the central retinal vein results in vascular degeneration and aneurysm formation on the venous side. In uveitis and diabetes, aneurysm formation is probably explained by the greater vulnerability of the retinal veins to noxious agents.

The cause of papilledema in malignant hypertension, may possibly be the impediment found in the venous return beyond the disc. The effect appears chiefly in the deep peripapillary vessels.

Apart from vascular sclerosis, occasional capillary micro-aneurysm is the commonest pathological lesion in the retina. These aneurysms are usually small and may be beaded or they arise from one side of the vessel wall or develop from adhesions of varicose loops. The latter two types are characteristic of diabetes. The capillary junction does not appear to be the site of predilection for any type of retinal micro-aneurysms.

Aneurysms appear to bear no direct relationship to age or to brachial blood

pressure but are found more commonly in chronic diseases of older people and in toxic injuries to the capillaries, particularly on the venous side. Their formation is related to the severity of the sub-oxidation and subnutrition to which the vascular wall is subjected. (14 photomicrographs.) Orwyn H. Ellis.

Friedenwald, J. S., and Maumenee, A. E. **Peculiar macular lesions with unaccountably good vision.** A.M.A. Arch. Ophth. **45**:567-570, May, 1951.

The fundi showed large oval orange-yellow lesions at the macula of such size and appearance as to seem unlikely that the vision could be as good as it was.

R. W. Danielson.

Gördüren, Süreyya. **Cysts of uveal origin in the vitreous.** Brit. J. Ophth. **34**: 749-751, Dec., 1950.

Cysts of the vitreous, of uveal origin, are rare and the literature is very meager. A case is reported with high myopia, more marked in the uninvolved eye. Abundant pigmentation in the anterior part of the vitreous, cysts in the less myopic eye, absent in the other, suggest a congenital origin of these cysts. The adjacency of the small cyst and the pigmented spherical body, and the presence of numerous pigment granules suggest that each is probably of uveal origin.

Orwyn H. Ellis.

Granström, K. O. **Retinal changes in coarctation of the aorta.** Brit. J. Ophth. **35**:143-148, March, 1951.

All cases of hypertension at Sodersjukhuset in Stockholm receive an ophthalmoscopic examination. It was noted that certain types presented an unusual fundus picture, that of coarctation of the aorta. There is narrowing or occlusion of the aorta at its junction with the subclavian, and a hypertension in the upper half of the body with hypotension in the lower half. Between 1947 and 1950, 40 undoubted cases of coarctation were examined in the eye department and in 24 of these a definite and characteristic pathological picture was seen. This was a corkscrew type of tortuosity of the arteries without appreciable change in caliber and with no change in the veins. There were no hemorrhages or exudates and the corkscrew effect was seen throughout the retina. These changes increase with age and are quite different from the vessel changes brought about in other types of hypertension. It is therefore possible to differentiate hypertension due to coarctation from other types, especially from juvenile hypertension. The corkscrew effect is best seen with the binocular ophthalmoscope.

Morris Kaplan.

Jain, Narendra Singh. **Glioma retinae. A statistical survey of new cases at the Royal London Ophthalmic Hospital (Moorfields Eye Hospital).** Brit. J. Ophth. **34**:709-719, Dec., 1950.

These cases were seen from 1925 to 1947 and were 0.0063 percent of hospital admissions. The oldest patient was 7 years of age. When bilateral, the disease tends to occur early and in four patients it was present at birth. Heredity is not important and the occurrence in male and female is about equal. About 60 percent of patients come with "amaurotic cat's eye," the remainder with squint, nystagmus, or other abnormalities.

Histological studies showed retinoblastoma 35 percent, neuroepithelium 16 percent, and mixed content 36 percent; 13 percent were undetermined. Glioma exophytum was twice as common as glioma endophytum. Choroidal infiltration was present in 10 percent and probably implantation through the subretinal fluid is the commonest mode of spread to the choroid. The optic nerve was invaded in

31 percent, beyond the lamina cribrosa in only 4 percent. The vitreous showed degeneration and contained clumps of glioma cells. Inflammatory reaction was present in the anterior segment of the eye in 71 percent.

Enucleation offers the best chances for permanent recovery. The results of radiation are not particularly encouraging; radium treatment gives the best results, deep X ray has proved a complete failure. As long as the tumor is intraocular, enucleation alone gives as good results as if it is followed by radiation. Should extraocular extension be found, exenteration, combined with radiation, is the treatment of choice. A combined intracranial and orbital operation is unnecessary. Radiation is not without damaging local effects and in two instances caused panophthalmitis. The prognosis depends upon the stage of the tumor, the type of treatment and the completeness of eradication.

Orwyn H. Ellis.

Levitan, B. A. **Clinical observations on the effects of injectable rutin, esculin, adrenoxyl, and vitamin E on the capillary fragility of diabetic retinopathy.** Am. J. M. Sc. **221**:185-190, Feb., 1951.

Diabetic retinopathy, resisting all therapy, is being studied in an effort to determine what value stabilizing agents such as vitamin P may have upon the weakened retinal capillaries. Some have thought that vitamin P stabilizes such capillaries and favorably influences increased capillary fragility often seen in both diabetic and hypertensive retinitis. Unfortunately many causative factors affecting capillary fragility are unknown. Furthermore, capillary status in general cannot be judged by the few vessels tested in the forearm and the smaller the area in which the petechiae are counted the greater the inaccuracy. In this study rutin was injected intravenously thus avoiding possibly faulty gastrointestinal absorption and was made soluble by compounding with methyl glucamine. Also two newer types of vitamin P, esculin and adrenoxyl, were studied. Vitamin E too was investigated because of its protective action in experimental vascular fatty degeneration. Routine capillary fragility tests were used and two weeks allowed between readings. Of six patients receiving rutin only two showed improvement in capillary fragility, thus the therapeutic potency appears slight. Likewise adrenoxyl did not show benefit to weakened capillaries and, in fact, two of the eight diabetic patients while receiving it developed extensive ocular hemorrhages. The tests with esculin failed to show any capillary stabilizing results in diabetes mellitus. Vitamin E given daily, alone or with ascorbic acid and rutin, even over long periods, did not bring about any sustained improvement in capillary strength. Claude L. LaRue.

Macrae, H. M. **Treatment of detached retinae.** Canad. M. A. J. **64**:335-337, April, 1951.

The patient should be put to bed and the head immobilized on a small pillow of sponge rubber with sand bags. The two eyes should be bandaged and covered with a black mask. The patient is allowed freedom of movement of his body. The eye is atropinized and re-examined after 4 or 5 days. The tear is localized with the help of Schweigger perimeter and Stines' tables. A barrage of partial and penetrating diathermy current is used. Postoperative immobilization of the head with freedom of movement of the body and bandaging of both eyes for two weeks, is advocated. The patient is allowed to be up in the third week, wearing stenopeic goggles. Irwin E. Gaynon.

Maumenee, A. E. **Diseases of the retina.** A.M.A. Arch. Ophth. **45**:572-604, May, 1951.

Under 18 headings the recent studies of

pathologic changes, vascular lesions and methods of treatment of diseases of the retina are discussed. R. W. Danielson.

Sjögren, Henrik. **Toxoplasmotic chorioretinitis cured with atepe (atebrin + plasmochin).** Brit. J. Ophth. **34**:752-753. Dec., 1950.

The blood-serum of the patient was positive for toxoplasmin. The eye did not respond to the usual treatment for choroiditis, but cleared completely after five days' treatment with atepe (atebrin + plasmochin). Fifteen months later it was without sign of recurrence.

Orwyn H. Ellis.

12

OPTIC NERVE AND CHIASM

Brognoli, C., and Citterio, M. **Liver function in alcohol-tobacco amplyopia.** Boll. d'ocul. **30**:12-38, Jan., 1951.

Twenty-four patients suffering from retrobulbar neuritis due to alcohol-tobacco intoxication were studied thoroughly as to sugar tolerance, Quick-Lipschütz test, Takata-Ara-Ucko test, van den Berg reaction, congo red test, blood protein content, and urine bilirubin and urobilin content. Each case is described extensively and summarized in a table showing that more or less severe hepatic insufficiency was present in many of these patients. It was most probably caused by the toxic effect of the same substance which caused the optic nerve disease; lessened detoxicating power of the liver might well play a role in the mechanism of the toxic amblyopia.

K. W. Ascher.

Pau, Hans. **Papilledema and retinal folds following operative hypotony for glaucoma.** Klin. Monatsbl. f. Augenh. **117**:591-597, Dec., 1950.

The author mentions previous cases of papilledema due to hypotony of the bulb, caused either by glaucoma surgery or other operations in which the eye has been opened. He presents the case of a 50-year-old man in whom severe headache and shallow anterior chamber were the only suggestive signs of glaucoma. Tensions after provocative tests were repeatedly normal. Cyclodialysis (Blascovics) was done after an acute attack and two weeks later a 2½-diopter elevation of the nerve head and radiating stripes and folds in the retina were seen. Three months later these had disappeared partially. The second case was in a 23-year-old in whom an Elliott trephine operation was done. Three days later the disc was blurred and there were folds in the retina. Pau ascribes the condition to trauma to the retinal and choroidal capillaries as a result of the surgery. The folds include all the layers of the retina and run in the direction corresponding to Henle's fibers. The papilledema is due to a partial vacuum produced by the lowering of the intraocular pressure.

Theodore M. Shapira.

Vetter, Joachim. **A pigment tumor of the optic nerve.** Klin. Monatsbl. f. Augenh. **117**:629-631, Dec., 1950.

The patient was examined for the first time in 1939 because of moderate strabismus of the right eye. The child was two years old. The anterior segments of the globes were not remarkable. A grayish-black discoloration of the right disc was noted. The outline was distinct, but there was slight protrusion. There was gradual loss of vision to light projection in 1945. The protrusion of the nervehead had increased, and was associated with atrophy. A malignant tumor could not be ruled out definitely, and the eye was enucleated. Numerous pigment cells were noted that extended from the optic nerve into its sheaths. In addition, the tissues were

edematous, but the edema did not extend behind the bulbus as it does in papilledema. Whereas pigment cells are not seen in the arachnoid of man, as a rule they occur in animals. For this accumulation of pigment cells, the name "arachnothelioma" is suggested. If the perineural tissue becomes hyperplastic, it may develop into a "black papilla." It may retain this state throughout life, but malignant degeneration is entirely possible. Optic atrophy is caused by pressure of the hypertrophic tissue, and not by infiltration. Theodore M. Shapira.

13

NEURO-OPHTHALMOLOGY

Alpers, B. J., and Yaskin, H. E. **Pathogenesis of ophthalmoplegic migraine.** A.M.A. Arch. Ophth. **45**:555-566, May, 1951.

The problem of the origin of the ocular paralyses occurring in the course of migraine, referred to as ophthalmoplegic migraine, remains unsolved. Of the several concepts which have been proposed to explain them, that of cerebral aneursym has received wide acceptance, though there has been little evidence to support it. In order to test the validity of the concept of cerebral aneursym as a cause of ophthalmoplegic migraine, two patients with this condition were studied by means of arteriography. In neither instances was an aneursym demonstrated.

The few cases on record with autopsy fail to clarify the cause of the ophthalmoplegia in migraine. It is probable that some vascular disturbance is associated with the ophthalmoplegic attack, but its nature has not been defined. Vasomotor changes affecting the nerve (Ehlers) and recurrent pressure on the nerve by dilatation of the vessels in relation to the affected nerve (Bramwell) have been suggested as the cause of the oculomotor paralysis. R. W. Danielson.

14

EYEBALL, ORBIT, SINUSES

Kennedy, R. J., and Vogel, A. W. **Intraocular infection with the gas-forming bacillus clostridium welchii.** A.M.A. Arch. Ophth. **45**:528-530, May, 1951.

A case of panophthalmitis due to the gas-forming organism Clostridium welchii (Clostridium perfringens) was reported in this country by Berry in 1932. Since then four cases have been added to the American literature and 23 to the foreign. Penicillin in the treatment of gas bacillus infection of body wounds has proved to be the most valuable therapy available, but experimental evidence in the use of penicillin and sulfonamides in controlled infections of the rabbit eye with Cl. welchii shows that when a lapse of more than three hours after inoculation occurs, local (including intraocular injection) and systemic therapy is of limited value. This case is the second recorded in which antibiotics were used, and its course indicates that more intensive measures are necessary in order to produce a cure. R. W. Danielson.

15

EYELIDS, LACRIMAL APPARATUS

Abel, S. **Haemorrhage from the lacrimal punctum.** Brit. J. Ophth. **34**:754-756, Dec., 1950.

The case of a 78 year old man who had profuse bleeding from the punctum is reported. Digital pressure over the sac at first increased the flow of blood but after a few minutes the bleeding stopped and did not recur. Orwyn H. Ellis.

Ashton, N., and Rey, A. **Hyaline infiltration of the eyelid.** Brit. J. Ophth. **35**: 125-133, March, 1951.

Hyaline is the term given to a heterogenous group of substances which share the properties of being translucent, re-

fractile and structureless. They are of a protein nature and are found in widely scattered areas of the body. The term of "hyaline degeneration" is most frequently used but this term is actually erroneous since hyaline occurs extracellularly and never within the cell. The proper term is hyaline infiltration.

A 22 year old Chinese had a tumor within the substance of one lower lid. There were no signs of irritation and the tissues of the bulb were not involved. The tumor was easily excised and the lid healed uneventfully. Tissue sections showed a diffuse, nonincapsulated tumor which consisted of hyaline eosinophilic masses. The authors concluded that this was a rare case of hyaline infiltration of the lid. Morris Kaplan.

Callahan, A. **The free composite lid graft.** A.M.A. Arch. Ophth. **45**:539-545, May, 1951.

An original method which is applicable to repair of a large central coloboma of the upper lid is presented; it consists of reducing by half the horizontal dimension of the coloboma, into which is free-grafted a sector of the entire thickness of the other upper lid. R. W. Danielson.

Raubitschek, E. **David's authorship of the so-called Sie-Boen-Lian operation for entropion, and suggested improvements.** Brit. J. Ophth. **34**:727-732, Dec., 1950.

Dr. J. David described an operation for entropion which was later known as the Sie-Boen-Lian operation. The operation, as described by both authors and modified by the present writer, consists of everting a distal block of tarsus made by section from the proximal portion and held in place with sutures. A special head bandage helps the lids to heal in proper position. The advantages of the operation are its simplicity, permanence, and good cosmetic effect. Orwyn H. Ellis.

Rotter, H. **Refraction in chronic blepharitis.** Klin. Monatsbl. f. Augenh. **117**: 578-586, Dec., 1950.

The beginning and course of chronic blepharitis is influenced by constitutional factors, excessive use of the eyes and errors of refraction. Patients with chronic blepharitis should be refracted and even small errors should be corrected.

Theodore M. Shapira.

Tóth, Z. **Modification of Blaskovics' operation for senile entropium and its use as a cosmetic operation against wrinkles and fat herniation of the lower lid.** Klin. Monatsbl. f. Augenh. **117**:611-614, Dec., 1950.

The actual cause of senile entropium, according to Blaskovics, is the decreased sympathetic tonus associated with advanced age. At the same time, "bags" are noted not only along the orbital margin of the lower lid, but also on the upper lid, where, because of the different anatomic conditions, they are mostly in the nasal and temporal third. The cause of these protrusions is the thinning of the tarso-orbital fascia, and a protrusion of orbital fat for which the author proposes the term "lipoid hernia of the orbit."

The following modification of Blaskovics' procedure was employed on a 67-year-old man who was operated on for bilateral senile entropium with fat herniation of marked degree. After the incision of the skin parallel to the lid margin, undermining of the skin, and excision of a temporal triangle, the fascia was incised in its entire length. The protruding fat was excised, and the fascia closed with three mattress sutures; these sutures were not tied but brought out through the skin and tied on the cheek.

The cosmetic effect is very satisfactory. This procedure is suitable also for fat herniation that is not associated with entropium. Theodore M. Shapira.

16
TUMORS

Beller, A. J., and Kornblueth, W. **Eosinophilic granuloma of the orbit.** Brit. J. Ophth. **35**:220-225, April, 1951.

Two cases of eosinophilic granuloma of the orbit are presented in detail. In the first, subjective improvement spontaneously occurred with erosion of the lateral wall of the orbit. The lesion occurs most frequently in the first two decades of life, more often in males, and a history of trauma is usually given. There is a rapid development and progression of the condition; X-ray findings are positive and eosinophilia is found in the circulating blood. Although rare, eosinophilic granuloma should be considered in the differential diagnosis of orbital tumors.

Orwyn H. Ellis.

François, J., and Rabaey, R. **Adenoma of the limbal conjunctiva.** Brit. J. Ophth. **35**:237-241, April, 1951.

Adenomata of the limbal conjunctiva may arise from the remains of the glands of Manz. These glands have been described in the limbal area of several animals but their presence in man is not generally accepted. Orwyn H. Ellis.

Jaensch, P. A. **Subconjunctival chondroma in congenital coloboma of the upper lid with malformation of the lacrimal canaliculus.** Klin. Monatsbl. f. Augenh. **117**:616-620, Dec., 1950.

A congenital coloboma of the left upper lid in a 10-year-old boy has been observed since the boy was three weeks old. A tumor, originating from the coloboma, extended into the upper tarsal fold and gradually increased in size. There was paresis of the medial rectus and superior oblique with hyperaction of the inferior oblique. In a two-stage operation, the tumor was excised, and the coloboma repaired. Microscopic examination of the tumor revealed, in addition to fat and loose connective tissue, small islands of cartilage surrounded by a dense capsule of connective tissue. The substantia propria did not take scarlet-red dye, and appeared a pale blue with hematoxylin-eosin. The cells were densely grouped, at places in a star-like pattern, and were of a darker blue. The nuclei were of a deep dark blue. On the basis of the large number of cells and their varying degrees of development, a diagnosis of chondroma was made. Such a tumor is rare in this location. The literature is reviewed.

Theodore M. Shapira.

Krümmel, H. **Eosinophile myeloma (plasmocytoma) of the orbit.** Klin. Monatsbl. f. Augenh. **117**:620-628, Dec., 1950.

A five-year-old girl gave a history of a painless swelling of the left upper lid that was first noticed three weeks before the first examination. There was slight redness of the skin. The small, moderately hard tumor was indolent, and was attached to the bone. Ptosis caused narrowing of the palpebral fissure to one fourth of the normal size. There was no displacement of the globe, its excursions were full, and vision was normal. X-ray examination showed an irregular cherry-sized defect in the left supraorbital region. After incision of the skin and periosteum, a grayish-yellow mass was curetted with a sharp spoon from a cavity in the frontal bone. After more than seven years, no recurrence could be observed, and the bony defect had not increased in size or shape. Microscopic examination of the excised tumor showed an abundance of eosinophiles, polymorphonuclear leukocytes, and giant cells originating from the capillary endothelium. A diagnosis of "eosinophile myeloma" was made. In the absence of plasma cells the diagnosis of the ordinary multiple myeloma could not be maintained. This is a benign but de-

structive tumor that has not been reported before to occur in the orbit.

Theodore M. Shapira.

17

INJURIES

Knapp, A. A. **Eye emergencies in industry; first aid treatment by the physician.** J.A.M.A. **146**:12-16, May 5, 1951.

Industrial injuries involving adnexa of the eye include ultraviolet radiation from the sun or from lamps and are treated like any burns. Chemical burns are more severe and require long continuous flushing with water or immersing the patient's head in a pail of water. Foreign bodies should be extracted through the wound of entrance if evident, or through an overlying incision. An exception is that of double perforation of the globe, by bullet or other missile, lodging behind the eyeball where it should be left to become encapsulated. Open orbital wounds not involving the eyeball require cleansing, sterile dressing, antibiotics, tetanus antitoxin and often suturing.

Industrial injuries involving the eyeball include ultraviolet burns caused by a welding flash, the sun or a sun lamp. Flash burns are most common and most painful, due chiefly to iris spasm. Frequent instillation of an anesthetic and of epinephrine and homatropine are indicated. Chemical burns require essentially this same management, but their greatest damage is often not revealed for several days. Foreign bodies enter the left eye more frequently than the right. They may generally be brushed off after instilling a local anesthetic and, if metallic, may form a rust ring, which should be removed with curette or bur. Dressing is not required. Since perforation of the globe occurs without symptoms, checking with ophthalmoscope and roentgenogram is indicated. An intraocular foreign body is always potentially disastrous and requires highly specialized care. Contusions are usually not dangerous yet may sometimes rupture the iris, and cause macular edema and retinal hemorrhage or detachment. Chorioretinitis from contusion, even with a hole at the macula, has been entirely cured and 20/20 vision obtained. Perforation of the globe is always dangerous, more so because of sympathetic ophthalmia, especially if the ciliary body is involved.

Claude L. LaRue.

Rizzuti, A. B. **Beryllium granulomas of the anterior ocular structures.** New York St. J. M. **51**:1065, April 15, 1951.

Beryllium granulomas of the lids and bulbar conjunctiva associated with keratitis were secondary to laceration caused by a broken fluorescent tube. (4 figures)

Irwin E. Gaynon.

Rosenthal, J. W. **Complete avulsion of optic nerve at the disc.** New Orleans M. and S. J. **103**:388-390, March, 1951.

From a fall a 13-year-old boy received a skin laceration along the lateral orbital rim, without knowledge of eye involvement. Later examination revealed not even light perception and replacement of the optic disc by a large black pigment spot from which tapering strands of glial tissue extended into the vitreous. Otherwise the examination of the eye, including X-ray study of the foramina, was essentially negative. It was assumed that in falling, some gouging intraorbital effect occurred, temporarily proptosing the eyeball, and tearing the nerve from its anterior attachment. Scar formation resulted. That the attenuated fundus vessels were fed by collaterals was noted later.

Claude L. LaRue.

18

SYSTEMIC DISEASE AND PARASITES

Francois, J., and Coffyn, J. **Retino-cerebellar angiomatosis of the von Hippel-**

Lindau type with associated visceral disease. Ann. d'ocul. 184:206-213, March, 1951.

The importance of recognizing extraocular evidences of syndromes or bodily disease patterns which may involve the eyes is emphasized. Many of the little understood ocular diseases, especially of the constitutional degenerative type, belong in this group. In the case presented, mesoblastic tissues were primarily involved and in the following order: 1. cerebellar angioblastoma with cyst formation; 2. polycystic renal disease; 3. retinal angiomatosis in one eye with initial involvement of only the superior retinal artery and vein. The constitutional predisposition only became apparent at the age of 30 years, which is later than usual. The hereditary factor has been recognized in only 20 percent of published cases. Chas. A. Bahn.

Hollenhorst, R. W., and Henderson, J. W. **The ocular manifestations of the diffuse collagen diseases.** Am. J. Med. Sc. 221:211, Feb., 1951.

The authors felt that the frequent presence of ocular manifestations in these diseases warranted further study in how they were alike and also unlike each other. Their work did not imply that there was a common eitology or interrelationship in these diseases. Histologically, however, they all attacked the connective and vascular tissues. The diseases considered were serum sickness, lupus erythematosus, periarteritis nodosa, dermatomyositis, temporal or cranial arteritis, Schönlein-Henoch purpura, thromboangiitis obliterans, rheumatoid arthritis, rheumatic fever and scleroderma. A table of the ocular manifestations of these diseases is shown. All the diseases except scleroderma could result in serious impairment of vision because of the toxic retinopathy which they are capable of producing. None of the ocular tissues or eyelids escaped, though not all were attacked in every disease.

Since ACTH and cortisone have been so beneficial, the effects of therapy and the progress or remission of these diseases has been much better understood because the internal ocular tissues could be seen and studied as the treatment was carried out. In most cases of dermatomyositis, disseminated lupus erythematosus, serum sickness, and in many with periarteritis nodosa, ocular lesions are absent, but it is suggested that a complete ocular examination including ophthalmoscopy be performed where a collagen disease is suspected. If a collagen disease is diagnosed the eye examination should be repeated frequently.

Francis M. Crage.

Kennedy, R. J., and Krichbaum, F. M. **Ocular findings in 133 cases of diabetes mellitus.** Cleveland Clin. Quart. 18:134-140, April, 1951.

Retinal hemorrhages occurred in 62 percent of patients with a systolic blood pressure above 160 mm. Hg. With lower pressure there was an incidence of 56 percent. Retinal hemorrhages increase in frequency with age, hypertension and duration of diabetes. Cataract was present in 38 percent of patients.

Irwin E. Gaynon.

Smith, Redmond. **Ophthalmomyiasis in England.** Brit. J. Ophth. 35:242-243, April, 1951.

A case of conjunctival sac infection with larvae found to be Oestrus ovis is reported. Distribution is word-wide in sheep, deer and goats but this is the first case reported in man in England. The eye is the usual site of human infestation.

Orwyn H. Ellis.

19

CONGENITAL DEFORMITIES, HEREDITY

Hudson, J. R. **Marfan's syndrome with retinal detachment.** Brit. J. Ophth. **35**: 244-245, April, 1951.

This case of Marfan's syndrome had an unusual complication, namely, retinal detachment. The retina was reattached by operation but three weeks later was again totally detached. After bed rest the retina remained in place and the final corrected vision was 6/18 and 6/12.

Orwyn H. Ellis.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Feiman, E. M. **Vision-inspection performance testing program.** Tr. Am. Acad. Ophth. pp. 427-431, March-April, 1951.

The minimum requirements for the following groups in a large roller bearing factory were established: 1. clerical and administrative workers; 2. inspectors and close machine workers; 3. operators of mobile equipment; 4. machine operators; 5. laborers; 6. mechanics and skilled tradesmen. Substandard employees, both potential and actual, are given thirty days to meet the requirements of their positions. Otherwise their services are discontinued until standards are met. The specific procedures involved in this test are not clearly stated. After installation of the Vision-Inspection program, the number of defective parts in the manufacture of roller bearings was materially decreased.

Chas. A. Bahn.

Hoskins, J. P., and Sorsby, A. **Richard Banister. Some further data.** Brit. J. Ophth. **35**:213-219, April, 1951.

It is shown that an invaluable document on the early history of British ophthalmology, M. S. Sloan 3801 (British Museum) was written by Richard Banister.

Orwyn H. Ellis.

Kirchbaum, F. M., and Kuhn, H. S. **Review of court decisions in eye injury cases.** Tr. Am. Acad. Ophth. pp. 436-440, March-April, 1951.

The authors briefly present the following abstracts of court cases illustrating the most important legal problems involved in industrial ophthalmology:

1. irregularities of state laws regarding "second injury cases,"
2. loss of vision due to bright lights—lack of diagnosis,
3. careful pre-employment eye examinations would reveal refractive errors,
4. visual loss based on uncorrected vision,
5. the necessity of careful inspection to avoid all eye hazards,
6. the responsibility of the ophthalmologist to know local statute limitations in order to safeguard rightful claims for loss of visual efficiency,
7. job requirements of high myopes,
8. lack of proper first aid,
9. ethical medical testimony and evaluation,
10. how to give exact evidence,
11. claimant is usually given the benefit of the doubt and
12. industrial awards for disfigurements.

Chas. A. Bahn.

Taylor, M. B. **Approved screening service for families of Indiana steel firm's employees.** Tr. Am. Acad. Ophth. pp. 440-441, March-April, 1951.

A large Indiana steel corporation, at the request of its employees, extended its visual screening program to their families. This program includes those of high-school age or older.

Chas. A. Bahn.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received at least three months before the date of occurrence.

DEATHS

Dr. Joseph Ivimey Dowling, Albany, New York, died March 22, 1951, aged 78 years.

Dr. John Francis Gibson, Olympia, Washington, died April 2, 1951, aged 70 years.

ANNOUNCEMENTS

RESIDENCY OPEN

A residency in ophthalmology will be open January 1, 1952, at State University of New York, Medical Center of Syracuse, School of Medicine. Please communicate with Dr. Harold H. Joy, 504 State Tower Building, Syracuse 2, New York.

EGYPTIAN MEDAL

The Ophthalmological Society of Egypt, in order to encourage scientific ophthalmic work, is offering a prize for the most valuable contribution brought before the annual congress of the society. For rules and further information, address the honorary secretary, Dr. Mohammed Bey Khalil, 15a Sherif Pasha Street, Cairo, Egypt.

SOCIETIES

AOS OFFICERS

At its recent meeting, the American Ophthalmological Society elected the following officers for 1951-52: President, Dr. Lawrence T. Post, St. Louis; vice president, Dr. Conrad Berens, New York; secretary-treasurer, Dr. Maynard C. Wheeler, New York; editor, Dr. Gordon M. Bruce, New York.

EGYPTIAN COUNCIL

At the annual meeting of the general assembly of the Ophthalmological Society of Egypt, a new council was formed and the following officers elected: President, Dr. Hassan Aly Ibrahim, assistant professor of ophthalmology, Faculty of Medicine, Kasr El Ainy, Cairo; honorary secretary, Dr. Mohammed Bey Khalil, 15a Sherif Pasha Street, Cairo.

LOUISIANA-MISSISSIPPI ELECTIONS

Dr. William B. Clark, New Orleans, was elected president of the Louisiana-Mississippi Ophthalmological and Otolaryngological Society at the recent meeting in Biloxi, Mississippi. Dr. W. L. Hughes, Jackson, Mississippi, was elected vice president, and Dr. Edley H. Jones, Vicksburg, Mississippi, was reëlected secretary-treasurer.

NEW YORK ACADEMY

The Section on Ophthalmology, New York Academy of Medicine, will have the following officers for the year, 1951-52: Chairman, Dr. James W. Smith; secretary, Dr. A. Gerard DeVoe. Meetings will be held the third Monday of each month, October through May, at the New York Academy of Medicine.

NEW YORK CLINICAL SOCIETY

The newly elected officers of the New York Society for Clinical Ophthalmology for the 1951-52 season are: President, Dr. Adolph Posner; vice president, Dr. Abraham L. Kornzweig; recording secretary, Dr. Bernard Kronenberg; corresponding secretary, Dr. Leon H. Ehrlich; treasurer, Dr. Edward Saskin; historian, Dr. David A. Newman. Dr. Samuel Gartner, retiring president, was elected to the advisory council.

The committee chairmen are: Program, Dr. Frederick Theodore; instruction session, Dr. Max Chamlin; legislative, Dr. Howard Agatston; membership, Dr. Bernard Fread; industrial, Dr. Joseph D. Schwartzman.

READING ALL-DAY MEETING

At the annual all-day meeting of the Reading Eye, Ear, Nose and Throat Society, held at the Reading Hospital, West Reading, Pennsylvania, the following program was presented:

Dr. Ramón Castroviejo, New York, "Modern concepts in glaucoma surgery," and "Methods and techniques in ocular surgery." Dr. Benjamin S. Shuster, Philadelphia, "The cranial nerves in otolaryngology." Dr. Charles H. LaClair, Norristown, Pennsylvania, "Spontaneous intramaxillary hemorrhage."

The following officers were elected for the ensuing year: President, Dr. Harold L. Strause; president-elect, Dr. J. Van Dyke Quereau; treasurer, Dr. Philip R. Wiest; secretary, Dr. Benjamin F. Souders.

NICARAGUA SOCIETY

Newly elected officers of the Nicaragua Society of Ophthalmology are: President, Dr. Ricardo Lacayo; secretary, Dr. Gilberto Cuadra; treasurer, Dr. Fernando Agüero; delegate to the Pan-American council, Dr. Emilio Alvarez.

CANTON SOCIETY ORGANIZED

Officers of the newly reorganized Canton (China) Ophthalmological Society are: Chairman, Dr. Eugene Chan; vice chairman, Dr Yih Shen; secretary-treasurer, Dr. E. Chang; members-at-large, Dr. S. H. Hsu and Dr. H. S. Chan.

PERSONALS

Dr. Gustav Erlanger, New York, lectured recently at the Eye Clinic, Yale University School of Medicine. The subject of his address was "Iontophoresis in ophthalmology."

The Purpose of the Guild

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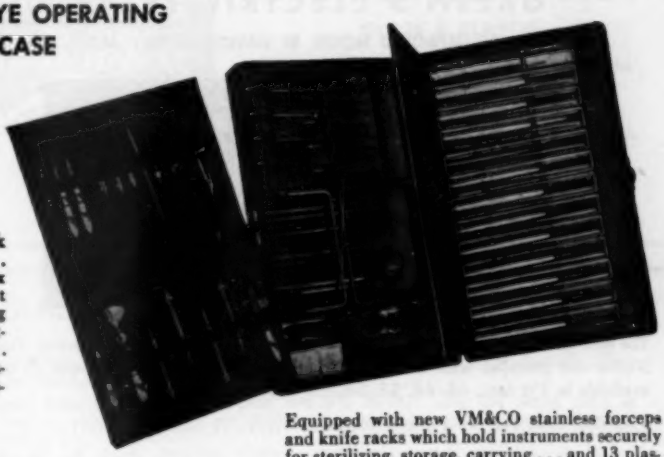

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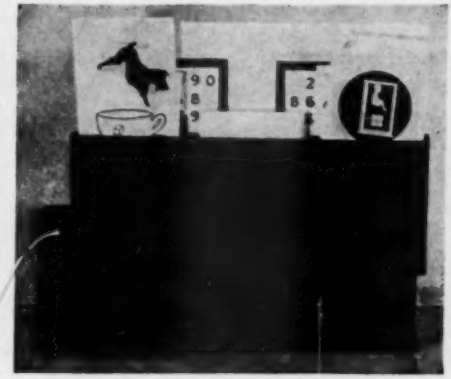

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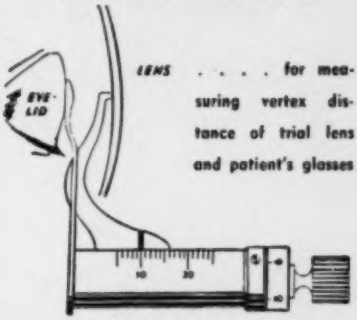

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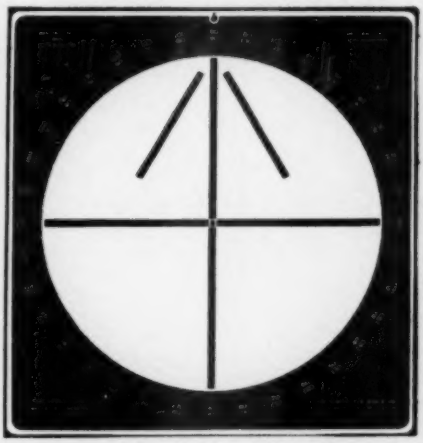

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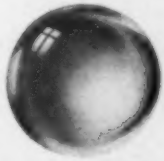

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